# consulting engineer

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Industrial Plant Design

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Regulators or Capacitors

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Steam Pollution Abatement

Industrial Dust Hazards

April 1954

## Dynamic Example

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*—Continued on page 6*

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NUMBER 4

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# consulting engineer

APRIL 1954

FEATURES

20 How Will the New Social Security Act Affect Engineers
*W. B. Fingal*

23 Fifty Years of Public Power
*Albert Lepawsky*

27 Current Trends in Industrial Plant Design
*Frank L. Whitney*

30 Radioisotopes for Measuring
*Edwin K. Langille*

32 Stiffeners for Large Air Ducts
*Paul Rogers*

34 Should You Specify Regulators or Capacitors
*R. D. Okerberg*

38 NSPE for Effective Professional Action
*Alan G. Stanford, P. E.*

41 Stream Pollution Abatement
*Harry D. Unwin*

45 Industrial Dust Hazards
*Maurice Kayner*

49 The Range Finder
*Dr. Gerald J. Matchett*

53 The Legal Aspect
*Melvin Nord*

DEPARTMENTS

Cover Personality — T. Cordtlandt Williams
10 Readers' Comment
14 Scraps & Shavings
17 Economic News Notes
18 Atoms in Action
56 News
62 Men in Engineering
70 Booklets
89 Meetings
90 Books
92 Advertisers' Index

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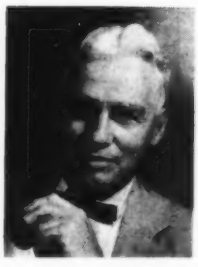


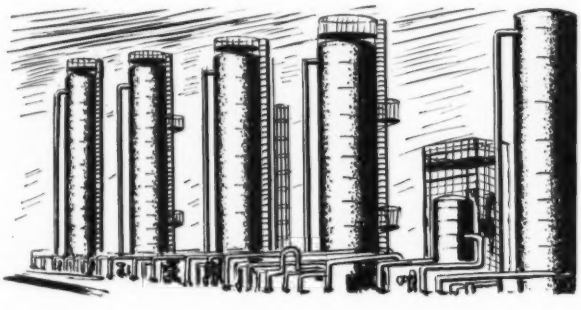
## Dynamic Example

*—Starts on front cover*

pletion of his work as project manager on S&W's portion of the huge construction that made possible the atomic energy facilities at Oak Ridge, Tenn., and the city of 75,000 which housed its original workers.

Rising from his first job as an instrument man to his present position has made Cort Williams keenly sensitive to the complex problem of bringing materials, engineering information, and the skills of people together in a coordinated effort. He considers his job to be building and maintaining the high spirit of organization teamwork necessary to meet this challenge.

Williams has a very real comprehension of the problems faced by younger engineers and of how to help them help themselves. He believes in encouraging men who are starting their engineering careers to quickly assume responsibilities to the limits their own judgment dictates. They should demonstrate their initiative and ingenuity by developing new and better ways of doing old and familiar tasks, using the past only as a foundation for the future. He smilingly offers one bit of homey counsel to younger engineers: if their opinions and suggestions are not sought by older and more experienced people on the job, they may well be in the wrong business.



Williams frequently puffs on a pipe and squints with friendly, quizzical eyes through the smoke. Talking through the haze, he'll say he believes that the foundation upon which S&W has been built rests on the process of taking younger men and encouraging them to assume responsibilities in line with their experience, of providing opportunities for them to demonstrate their qualities of leadership and initiative, and of advancing them steadily as their experience develops. As he himself puts it, "It is human nature that we are never quite so proud of anyone as the one we ourselves can feel we have helped a bit."

### ME From Bucknell

Born in 1897 at Vineland, New Jersey, Cort Williams attended his local high school and there participated in athletics, an activity he carried over into his college years. He entered Bucknell University at Lewisburg, Pennsylvania, in 1916 and was graduated in 1920 with the degree of BS in ME. Last June, Bucknell gave him an honorary ME degree.

He was first introduced to an S&W project in 1923 at Camden, New Jersey, where an industrial plant was being extended. Less than one year later, he was a chief mechanical inspector on a power station in Massachusetts. And by the time mid-1925 arrived, the young man who was a good listener as well as a question raiser, was an S&W resident engineer in charge of the field engineering work for the construction of a steam power plant in Texas.

Williams became part of the Boston executive staff in May, 1944. He still travels extensively to inspect company projects.

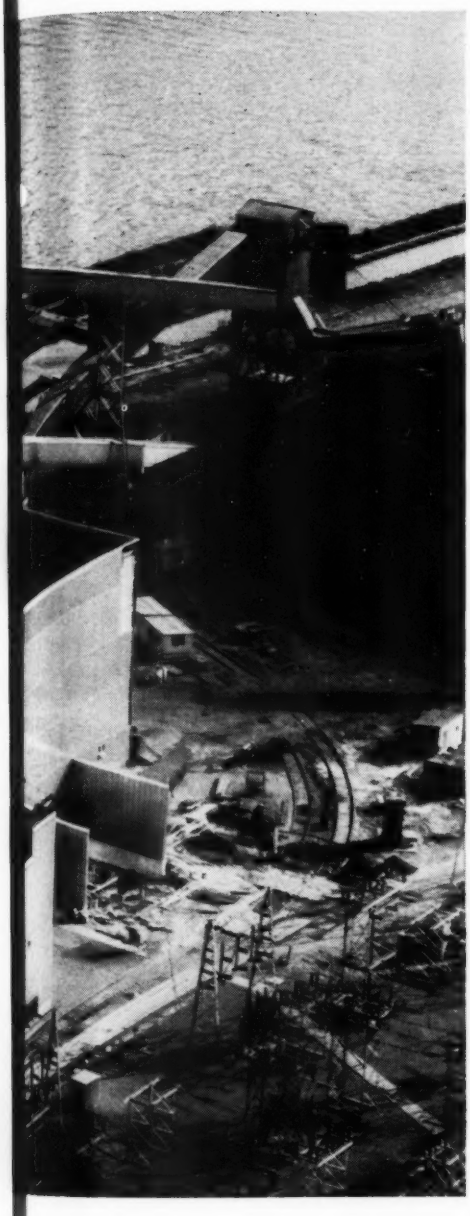
This grey-haired, but youthful-acting and -looking executive is still somewhat surprised that engineers are initially taught to think independently as "rugged individualists" and yet they readily sit down and think through a course of action on which all will agree. He sees his own particular job as something akin to a catalytic agent in this process. It defies exact definition, but anyone who works with Cort Williams finds himself being encouraged to advance his own views.

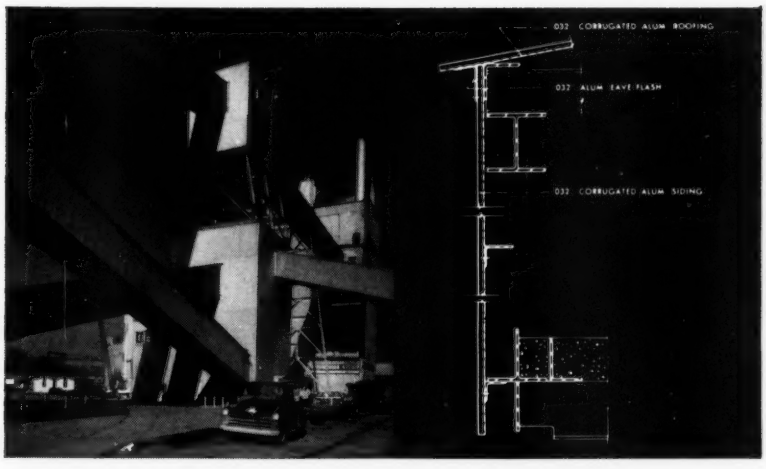
Today, with such monumental tasks as the 1942-44 work on Oak Ridge and other comparable jobs behind him, Cort Williams looks at the future with assurance. With the tremendous and continuing technological development taking place in this great country, he feels the only problem is to recognize and evaluate it properly and to develop people with the courage and the vision and the abilities to meet the requirements as they arise.

### More Hobbies

Williams says that for "a man with practically no spare time" he has "more hobbies than anybody!" On his office wall are some of the many color photos he has taken. At home is a small studio and some of his oils; "terrible art but lots of fun trying," he says. In his basement is a fully equipped shop; "no time to make anything but it's fun just to watch the motors run!" On Martha's Vineyard he has a summer cottage and a fishing boat; six miles of water separate him from "the continent." He does more relaxing per hour here than he does anywhere else.

Williams likes young people, sees a great future for them, and refrains from oldster-primed advice on most counts. But he feels that if young men starting out in engineering find themselves doing work that they enjoy, working with associates they enjoy, they will inevitably get that chin-lifting sense of accomplishment which is just another way of saying they are well on their way to getting a lot out of life.



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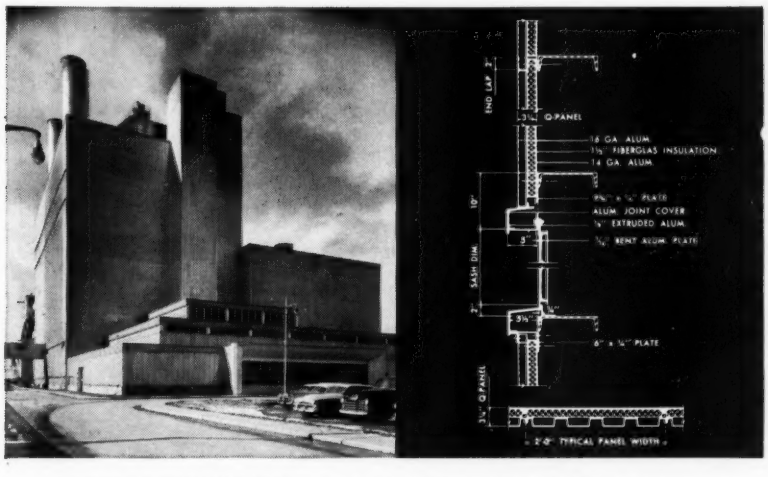


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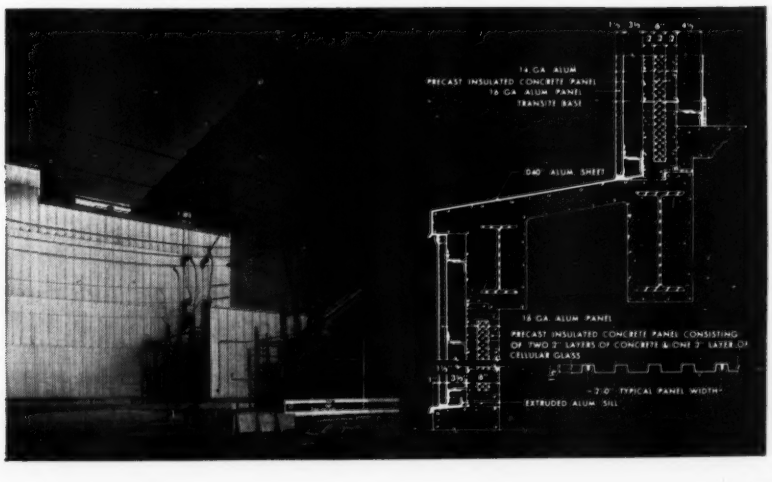
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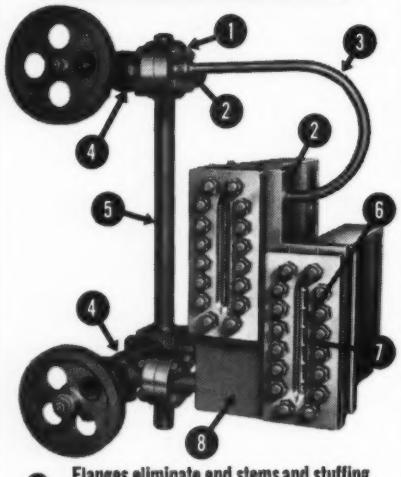

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# READERS' COMMENT

### Shortage of Engineers

Sir:

After reading your recent column ("Scraps & Shavings"—Feb.) on the shortage of engineers, I thought you might like to see the enclosed news release on the average starting pay of mid-year engineering graduates at Illinois Tech.

We would be pleased to supply you with any other information needed along this line.

Victor J. Danilov
Supervisor
Armour Research Foundation
of Illinois Institute of Technology

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Sir:

Congratulations to you and your staff on the top notch job being done in publishing your attractive publication, CONSULTING ENGINEER.

I would like your permission to reprint the February, 1954 "Scraps & Shavings" editorial on the shortage of engineers in a future issue of the Engineers' Society of Milwaukee's monthly publication *Milwaukee Engineering.*

William H. Evans
Managing Editor
Engineers' Society of Milwaukee
Milwaukee 8, Wisconsin

● PERMISSION GRANTED—ED.

Sir:

I would like permission to reprint with acknowledgment your "Scraps and Shavings" column from Page 14 of the CONSULTING ENGINEER, Volume III, Number 2, February, 1954. This would be printed in our association publication, *The Integrator.*

R. Habermann, Jr.
Editor
The Integrator
Schenectady 5, New York

● AGAIN, PERMISSION GRANTED—ED.

### Union Supporter

Sir:

Permit me to add my little contribution to the question of the unionization of engineers in connection with the article by Mr. Shumaker in your January 1954 issue.

At the beginning of the article Mr. Shumaker tries to present a horrifying picture of the possibility of engineers going on strike. He apparently had no idea of the envy and satisfaction of most of the engineers who read about the success of engineers who struck together with the other workers at the Arma Plant in Long Island.

Mr. Shumaker concedes that the less-than-average engineer would gain through collective bargaining "at the expense of the above average individuals." Here Mr. Shumaker displays partly a great lack of imagination, and a great ignorance of facts. Not only is it possible to design an organization that considers the individual qualities of its members, but there are qute a few such organizations in fields in which individual performance means everything. I refer to the Actors' Equity union to which all actors of the theater belong, also to the union of the movie artists in Hollywood, and to the American League of Musical Artists, an organization of the greatest solo artists, which is different from Petrillo's Associated Musicians of America, A. F. of L., which has only orchestra musicians as its members. Unions regulate minimum salaries only, and no union ever prevented an employer from paying more to a better man, provided that man did not endanger the employment of the others.

Now we are coming to the interests of the self-employed consulting engineer which your publication is supposed to represent. Many an engineer leaves his employment and starts a consulting practice because he is underpaid and hopes that he

will accomplish more as a consultant. Such an engineer constitutes the worst kind of competition to other consulting engineers already established as such because being a beginner he will undertake engineering work at a fee below that established by the various engineering societies. Here we may just as well point out that Mr. Shumaker condemns the fixing of remunerations for employee engineers while forgetting that most of the professional engineering societies, first of all the American Institute of Consulting Engineers publish fee schedules.

Right now a mediocre engineer of about 32 years earns as much as an electrician or steamfitter in spite of the great shortage of engineers. When a new generation of engineers grows up, the relative material position of the engineer is very likely to become worse. He will be ground between the two millstones: on one hand low salaries due to lack of organization, on the other hand high cost of living due to the unionization of labor. This will lead to another shortage of engineers, also the quality of people choosing engineering for their life's work will suffer, and so will their accomplishments.

I hope that if you are guided by the intellectual honesty behooving the editor of an engineering magazine you will publish the above lines, also the contents of the paragraphs marked red on the enclosures. This writer, like most all employee engineers, is under too much terror to sign his name, so kindly excuse this omission, which, by the way, does not mean anything.

• IT IS NOT THE GENERAL PRACTICE OF CONSULTING ENGINEER TO PUBLISH UNSIGNED LETTERS. NAMES WILL BE WITHHELD UPON REQUEST OF THE WRITER. — ED.

### Information Please

Sir:

Your article on the activities of the New York Association of Consulting Engineers in the March 1954 Edition shows an excellent example of cooperation between the Engineering Profession and the Architectural Profession.

We will appreciate having you send us the name and address . . .

James N. DeSerio, P. E.
Consulting Engineer
Buffalo 2, New York

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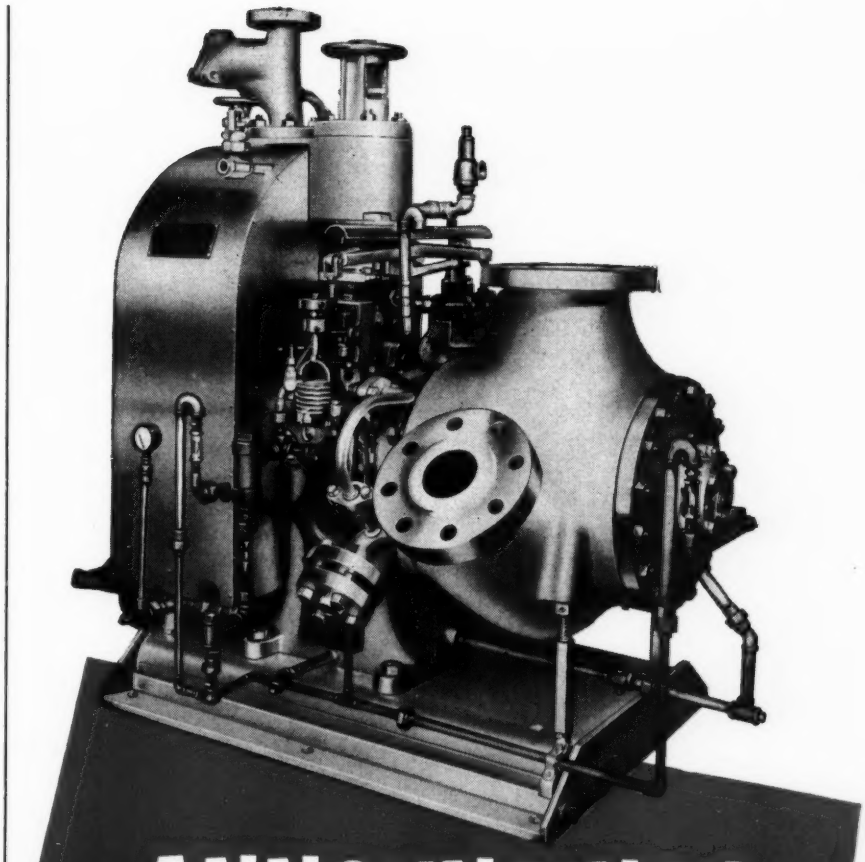

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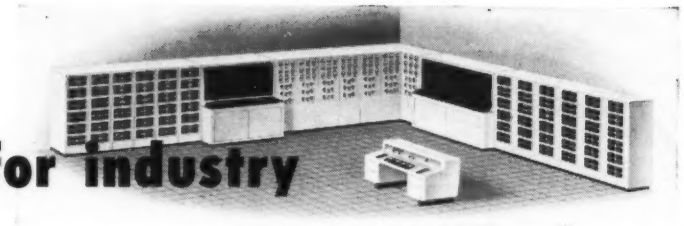

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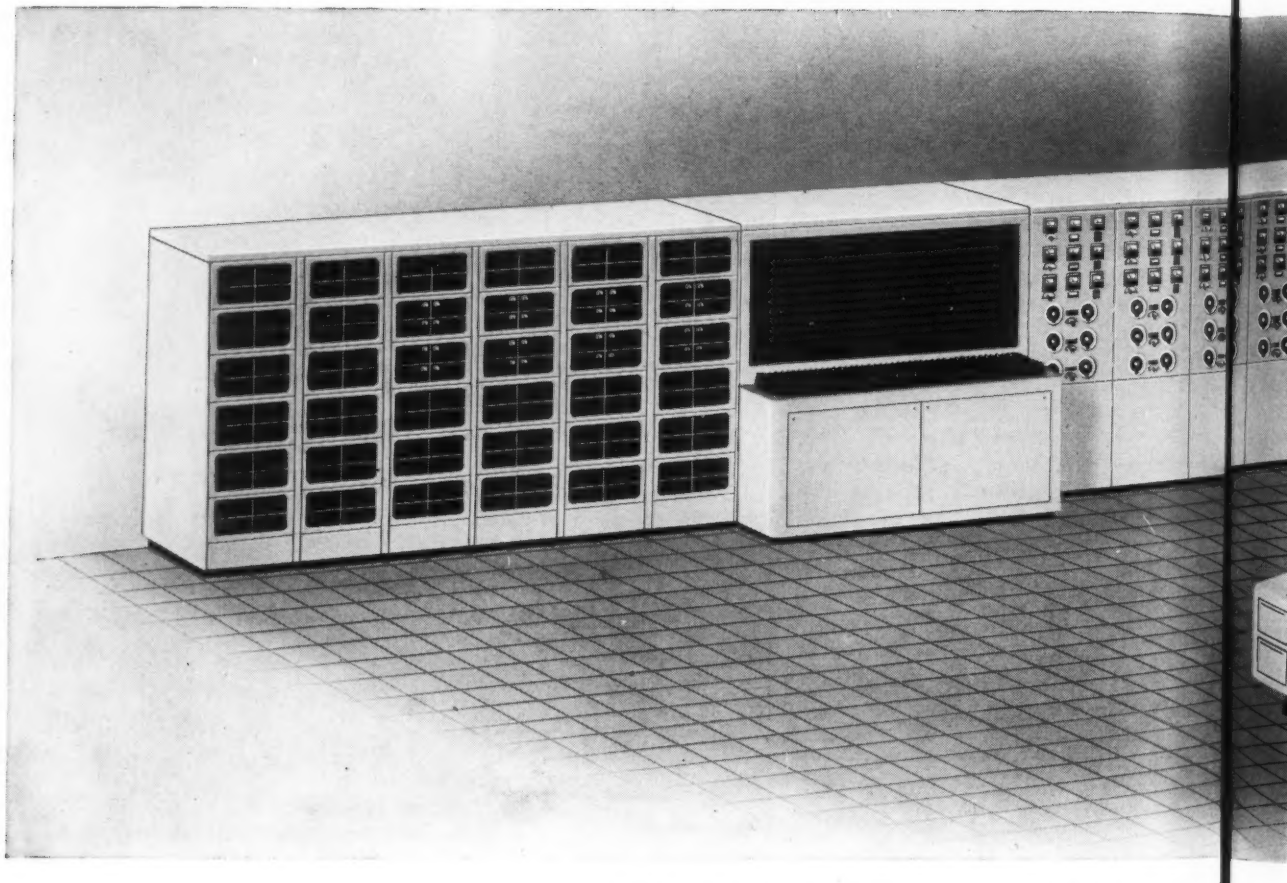

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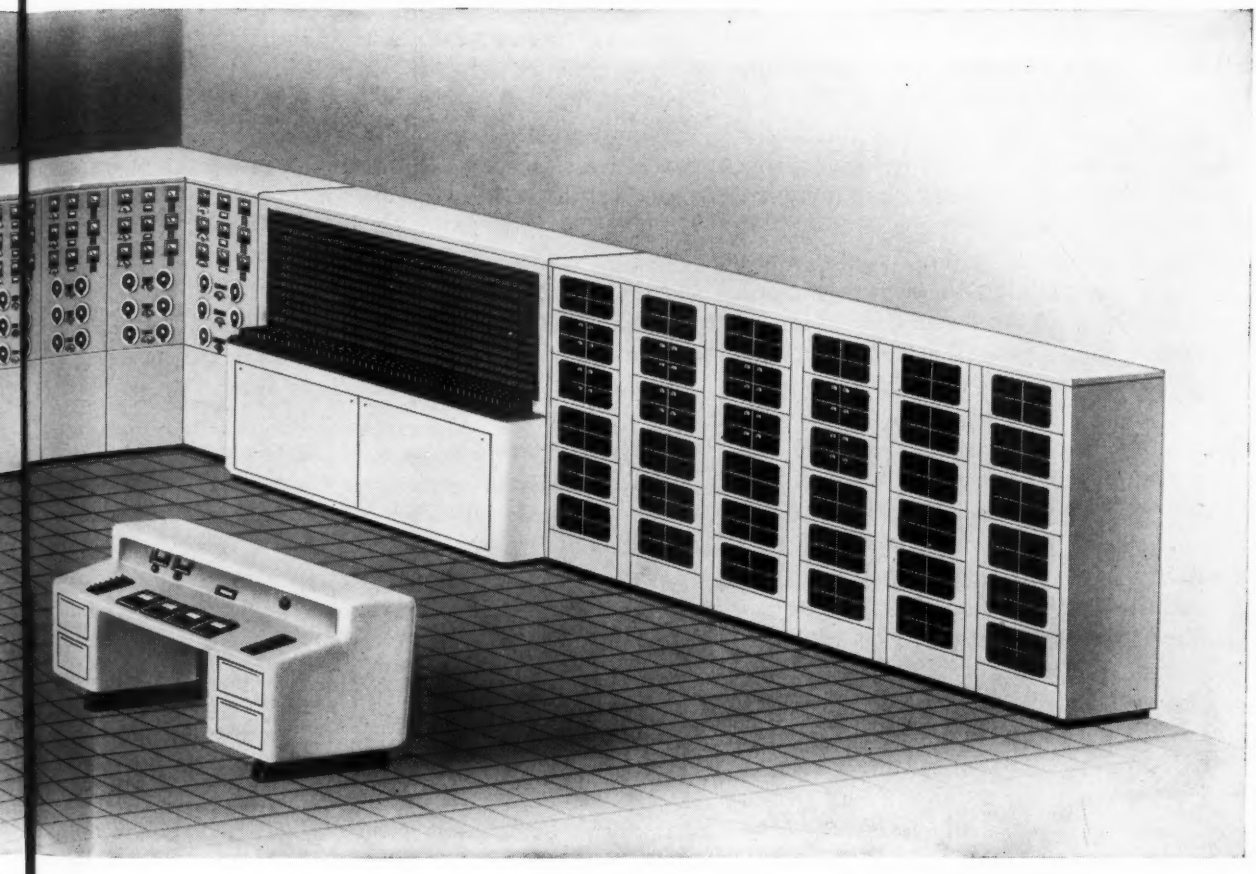

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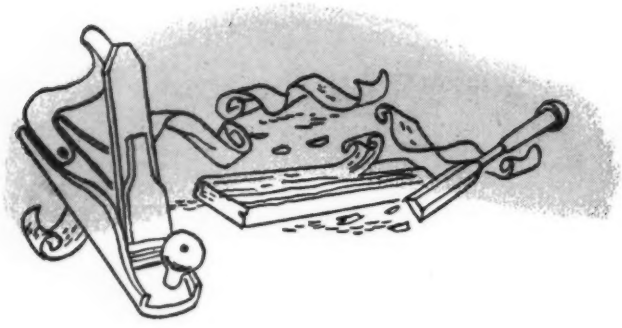

# SCRAPS & SHAVINGS

THE AMERICAN CHEMICAL SOCIETY has turned down the application for membership of Irene Joloit-Curie, the French scientist. This has caused quite a stir among the editors of the *Bulletin of the Atomic Scientist,* who do not think that a person's political affiliation should have anything to do with his qualification for membership in a technical society. The editors of the *Bulletin* wrote a rather good piece explaining their position, and while we would disagree with them on some of their minor arguments, we agree that it was particularly stupid of the American Chemical Society to make a *cause celebre* of the application for membership by an obviously technically qualified and widely known scientist.

The American Chemical Society turned down the application because of Madame Joliot-Curie's communist activity. We wonder just what harm she could have done the Society or our National security by belonging to this Society. About the only thing she could have got out of the membership would have been some of the Society's publications, which she can still subscribe to as a non-member at a slight additional cost. We would be willing to place a small wager that she or one of her associates is now receiving most of the publications of the American Chemical Society.

We agree with the action of ACS to the extent that we can see no good reason why potential, or actual enemies should be given membership in scientific societies or should be kept up-to-date on our research and developments by mailing them the very latest printed papers. We object to passing out this material to the extent that CONSULTING ENGINEER does not comply with requests for copies of tear sheets which come from foreign countries unless they are requested by obviously responsible employees of reputable firms. We really do not labor under the delusion that these restrictions keep our book, or any other magazines whose publishers follow that same policy, out of the hands of communists. It is merely that we are going along with the ideas of the State Department and the Department of Defense, that if objectionable groups in foreign countries do want our publications, they should have to go to the trouble of getting hold of a copy through other than the simple means of writing to us and asking for one. We cannot control the ultimate destination of every copy which leaves the press, but we don't need to put ourselves out to be helpful to those groups.

On the other hand, we wonder about the American Chemical Society's action against Madame Joliot-Curie in that they do not seem to be inclined to turn down other foreign applicants for membership—and we seriously doubt that they fully investigate the political background of those other applicants.

The most recent issue of *Standard Rate & Data* shows that The American Chemical Society publishes *Analytical Chemistry, Chemical Abstracts, Chemical and Engineering News, Industrial and Engineering Chemistry, Agricultural and Food Chemistry,* and the *Journal of the American Chemical Society.* Foreign circulation on only three of these is given, but there are 8003 copies of *Industrial and Engineering Chemistry,* 6833 copies of *Analytical Chemistry,* and 3935 copies of *Chemical and Engineering News* sent out of the United States each month by the publishers. We understand that many of these go to locations where it is not only popular but very nearly essential to be a communist or at least sympathetic.

The illogical position of the American Chemical Society lies in its having turned down the application of a prominent scientist—for communist activity—while at the same time having on its roles many less qualified foreign members, a percentage of whom are no doubt red enough to make Madame Joliot-Curie seem just a little left of blushing pink. Further, it would seem that if ASC has suddenly decided that it should begin to peek over its member's political shoulders, it could at least have put itself into a better position by cutting the flow of its publications to countries who make no bones about being communistic.

On top of this, the Society makes it plain that the Joliot-Curie case does not signify that it intends to keep out *all* communists. The logic of that position escapes us entirely. ▲▲

# ECONOMIC NEWS NOTES

*E. F. Mac Donald*
INDUSTRIAL ECONOMIST

RADIOS, REACTORS, RIBBON—It hasn't reached the mail-order catalog stage yet, but you can buy a nuclear reactor from a catalog. North American Aviation's atomic energy research department has published a brochure of illustrations and specifications to guide industrial, scientific, and medical buyers interested in a low-cost neutron source for general research purposes, a source of neutron beams for biological or therapeutic uses, or a source of neutron beams for radioactive chemicals and isotopes. Since it's custom work, there are no price quotations.

JOHN Q. NOSTRADAMUS—While not in the same class with old Nostradamus's crystal ball, the annual survey of consumer finances by the Board of Governors of the Federal Reserve System is one of the best indicators of attitudes and possible actions of the most important factor in any business—John Q. Public. The preliminary report on the survey, which is eagerly awaited as a guide to consumer buying trends, indicates that on the whole, consumer spending plans are down compared with the record-year 1953 but are satisfactory in comparison with other relatively good years.

EXPENSIVE OBSOLESCENCE—Mr. F. Geier, president of Cincinnati Milling Machine Co., in an interview with ***U.S. News & World Report***, (Mar. 12, 1954) held that there are about one and a quarter million machine tools in this country that should be regarded as obsolete. He estimated that replacing them with available up-to-date machines that would be a third more productive would result in savings of direct costs alone of $1.5 billion.

LEASE-PURCHASE—The availability of leasing and deferred payment plans for acquiring industrial equipment has been extended to the giant textile field. Warner & Swasey and the Universal Winding Co., for example, have announced plans for acquiring textile machinery without plunking down the full purchase price. Elimination of the investment ordinarily required to obtain new machinery could have some interesting effects on the amount of obsolete equipment in use—and on competition.

SKY TAXIS—Possible sites for heliports in Baltimore are described and located in a report recently released by the Baltimore City Planning Commission. "A Study of Heliports for Baltimore City" considers also present and future requirements of these airports of tomorrow and traces inter-city and intra-city air routes.

INTERESTING STUDY—The Machinery & Allied Products Institute has presented in its ***Capital Goods Review*** a number of approaches to the problem of determining the current position of the capital goods industries. Changes in the relative importance of business capital outlays to the total private production of goods and services were considered in the February 1954 issue. This approach indicated that postwar plant and equipment outlays combined have not accounted for more than a normal percentage of the gross private product. There was no suggestion of excessive investment since the War nor any indication that the recent rate of plant and equipment investment is an unsustainable one.

ETT-100—Is the little name given to a big-brained electronic computer recently put into operation at Stevens Institute of Technology at Hoboken, N.J. Built at the college to aid research on naval and aircraft, the computer has a capacity 60% greater than similar machines. Able to handle differential equations, ETT-100 can be used in research on moving objects.

BIG MONEY—A survey by the Municipal Finance Officers Association shows that 141 municipalities have planned capital projects for the next five years that will have a total cost of almost $5 billion. Twenty-four percent of this amount will be spent this year, 20% next year, 17% in 1956, 16% in both 1957 and 1958, and 7% is unscheduled. Significantly, the projects represent needs and not make-work, and financing is not regarded as a particular problem.

NO DREAM—It may be "old hat" to many engineers, but to laymen and most factory owners, the concept of the fully automatic factory is still strictly Buck Rogers stuff. Appearing before a meeting of the Institute of Radio Engineers, Mr. G. Post, Chief Engineer of General Cybernetics Associates, stated that the fully automatic plant is no longer in the realm of speculation and is available to any manufacturer willing and able to meet its cost. Comes the day of automatic factories there will be some new economic and sociological problems to be ironed out.

PROTECTIVE CONSTRUCTION—The 100% accelerated amortization allowed by the Government on plant construction designed to minimize bomb damage has been extended to construction in all 193 target areas designated by the Civil Defense Administration, and the minimum outlay requirement of $25,000 has been dropped. Eligibility is based on production of items for which ODM has created expansion goals.

INVESTMENT STIMULUS?—Expected to start the year out strong and weaken later on, plant and equipment outlays were estimated to be set for a 4% decline this year. Analysts are rechecking to see if such provisions in the recent tax revision bill as those for changes in taking depreciation might not stimulate greater investment this year in new plant and equipment.

# ATOMS IN ACTION

INDUSTRY FACES still the problems of investment and operating costs on the one hand and the problems of revenue from the sale of products on the other; these problems will have to be solved before any private company can seriously consider investing substantial amounts of money in atomic power plants — such are the views of R. L. Doan, manager of Phillips Petroleum's atomic energy division.

APPARENTLY THE TIME is right according to Duquesne Light Company of Pittsburgh. They have offered the AEC a site for a power reactor rated upwards of 60,000 kw; they would operate the electric generating plant at no cost to the government. Further, they offer to operate the reactor part of the plant, paying the labor costs entailed; they will assume $5 million of the research, development, and construction costs of the reactor portion of the plant; they will pay the AEC 48.3 cents for each million Btu of steam used in the turbines, this rate advancing annually to 60.3 cents after five years; and Duquesne waives any reimbursement resulting from a termination of the contract. It is estimated that this arrangement will save the government some $30 million in its projected five-year program to advance reactor technology.

NORTH AMERICAN Aviation is also joining the AEC's five-year reactor program by following up its initial work on the sodium-graphite reactor in building a 20,000-kw unit (without equipment for generating electricity). This is a $10 million project in which North American is picking up $2.5 million of the tab.

FIVE TECHNOLOGIES are being followed in the AEC's new program. Duquesne is taking up the pressurized water reactor in its proposal; North American is working with the sodium-graphite reactor. Still to be investigated further is the breeder reactor, the experimental boiling water reactor, and the homogenous reactor. The AEC is also looking for bidders who will take a fixed-price contract to develop a package atomic power plant for military use; the reactor would probably use enriched uranium fuel and be moderated as well as cooled by ordinary water under pressure.

OTHER COUNTRIES are also going ahead with their own reactor work. A quick look around shows such projects as Great Britain's plans to build a breeder reactor to generate power at something around the level of 50,000 kw; the reactor site is reported to be planned for Scotland. The Dutch are going to build an experimental atomic power station at Utrecht; within five to eight years they expect to produce electricity as cheaply as they get it from coal. The government of India plans to have its first atomic reactor in three years. And down under in Australia, it is planned that the state's next power station, to be needed around 1960, will be powered by the atom; they now use coal hauled in from New South Wales or low-grade fuel brought in over long distances by rail from their own coal fields.

NEW TECHNOLOGY altogether is suggested by a proposed system wherein fissionable gases expand in a closed-cycle turbine; the fission would take place under critical pressure when the gas is first compressed, driving the turbine as it expands later.

**The Rock River Generating Station of the Wisconsin Power and Light Company. Consulting Engineers: Sargent and Lundy, Chicago. Present capacity: 60,000 k.w.**

Tomorrow's requirements were very much in the minds of Wisconsin Power and Light Company officials and engineers when they started planning the coal-handling system at their Rock River Station. They combined their own experience with the skill of their consulting engineers, Sargent and Lundy...and the conveyor design "know how" of Chain Belt Company Engineers. The result—a coal-handling system modern as tomorrow, dependable, and trouble-free...one which will be easily speeded up to handle the doubled station capacity required for the future.

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# How Will the New Social Security Act Affect Engineers?

**W. B. FINGAL**
**Washington Correspondent**

CE exclusive

BY THE TIME the 83rd Congress winds up its current session, most likely in July, the 1954 legislative accomplishments will have included various changes in the national Social Security Act. From the standpoint of the number of proposals brought out in this Congress, touching on nearly every aspect of the Social Security program, the revisions might well total up to sweeping changes.

One of the principal Social Security changes aimed at in this administration and Congress is a considerable broadening of coverage under the Act. The scope of this broadening may in the final legislation be less than is now being advanced in several important areas of influence, but in greater or lesser degree the expansion will be accomplished. This is because of the growing strength behind the long-term view that Social Security must inevitably provide universal coverage.

### Professional Group

Of the various occupations that may be brought under the Social Security wing in this year's legislation, there is included the broadly defined professional group, including the consulting engineer in private practice. This inclusion is not a new idea, but pressure is somewhat stronger this year. Too, whereas some professions, through representation by their societies, had taken a firm stand earlier against their inclusion, they are not so certain now, and some are actually even shifting their view on the question.

The legal profession, for example, has not only backed off from a national stand against being put under Social Security coverage, but has had some of its regional groups make representations to Congress in favor of inclusion. The American Bar Association had officially opposed earlier proposals to bring the legal profession into Social Security provisions, but at its convention in Boston last August, the meeting refused to adopt a resolution reaffirming its earlier position. The matter was referred back to an organization committee, and the convention report noted that on this question a shift had been shown from settled opinion to one needing further study.

In the most recent example of lawyers' views, Senator Humphrey of Minnesota, at the time of this writing, requested that there be printed in the *Congressional Record* a resolution by a county bar association in his state "emphatically favoring the extension of Social Security so as to include the legal profession."

### Engineers' Opposition

As it appears now, the National Society of Professional Engineers will appear before Congressional committee hearings in opposition to their members being included in Social Security coverage, since the poll of last fall showed 54.6 percent against mandatory coverage. But at the same time, NSPE spokesmen admit that their members' present attitude is based on coverage under the Act as it now stands and their understanding of what corrective revisions are being put forward in legislative proposals. There are possible revisions, they add, which in their view might alter the members' viewpoint.

This is the nub of the matter in the official views by virtually all of the professions' organizations—that there are conditions under which they might find Social Security coverage acceptable for their members. Whether the majority of the members understand these conditions, as well as the Social Security Act generally, has been shown doubtful, at least in the American Bar Association survey, which noted that the "greatest number of uninformed were opposed to inclusion." Even if this is not entirely true in other professions, it would be

well for the engineer to brush up on the Act as it stands, and as it might be revised to affect him this year or later. Legislation to amend the Act has not yet firmed up, and there is time for the engineer to take a knowledgeable stand for or against the inclusion of his profession.

### Changes in the Act

Since the professional societies have granted a contingency of acceptance in their views, it should be noted in glancing over the history of the Social Security Act that all of its provisions have been demonstrated to be variables. This is clear by reason of the changes already wrought in the Act, and the expressions of views on it by former and present Administrations and Congresses, as well as those by potent private organizations. These attitudes indicate that while universal Social Security is a definite aim, it is not felt that it should be thrust upon the entire nation merely to accomplish that purpose. Rather, it can be seen that the intention is to provide a really satisfactory benefit to all of the people in the nation.

To appreciate the continual changes in the national Social Security program since its beginning, it should be recalled that the original Act of 1935 formed but the basis of the law as it stands today. Its coverage was limited. Its benefits were meagre compared to present provisions. Qualification restrictions ruled out many of the aged from benefit payments, and when the law first came into being, it provided for payments to the retired worker not to begin until 1942, seven years later.

### Qualifications For Benefits

In 1939, broadening of the Social Security program began with amendments to the Act which hastened benefit payments to the aged, and provided monthly payments to the dependents and survivors of insured workers. But even with this trend toward liberalizing the Act, one aspect which has since come to be regarded as its weakest point was retained—the ruling out of retired workers from benefit payments if they had any earnings whatever.

This is the proviso, along with its subsequent history, to be especially noted by the professional worker, for it is the focal point in some professions' objection to their inclusions in the Act. It is felt that while the professional worker is fortunate in being engaged in a vocation which enables him to do some work right into his closing years, at the same time his superior earning ability, which is his by right of study and application, might bring him enough earnings even after slowing down because of age to rule him out of retirement benefits. It is this consideration which shapes the opposition by the professions' organizations.

From the low point of this proviso, when a retired worker was shut off from retirement benefits if he had any earnings whatever, 1950 amendments to the Social Security Act began the alleviation of this iniquity. The 1950 revision provided that a retired worker might earn up to $50 monthly without losing retirement benefit rights. Still not much, but it was a start. A further amendment in 1952 raised to $75 monthly the amount the retired might earn without affecting his benefit payments, which is where the law stands now.

### Proviso Causes Hardships

That this proviso, even though twice improved, still often constitutes a cruel iniquity in its application was pointed up recently by a prominent woman author. Her article cited the case of a 71-year old man who attempted suicide because his monthly Social Security payments had been suspended as a penalty for failing to report that he had made $18 more in two months than he was allowed to earn as an old-age beneficiary. The author cites many other examples of such hardship under the proviso and concludes with the suggestion that "if Social Security is to be a real insurance program for the aged, it should be administered so that the people get their annuities no matter how much they earn."

The lady's view is not novel today. A great many are of her opinion. There are those in important quarters who see the idea as not at all unreasonable on the basis that while the throwing off of the restrictions on earnings would increase payments, the increase would be largely offset by the decrease in actuary costs.

But whether it is reasonable or not, the thinking along that line continues to advance. True, it advances slowly insofar as it is translated into legislation, but it does move on. One current Senate bill would raise the earnings limitation to $100 a month. And since the monthly basis brings in another

SOCIAL SECURITY COVERAGE FOR CONSULTANTS MAY MEAN MORE FORMS AND FIGURES. IS IT WORTH IT?

recognized inequity, in that a beneficiary might exceed his allowed earnings in one month and yet earn nothing more for the rest of the year, the basis will almost certainly be changed to one of annual earnings. This already applies to the self-employed, so that whether or not it becomes a general provision in this year's amendments, it applies to the professional worker if he should be drawn into Social Security.

The 1950 amendments to the Act were the first to embrace coverage of certain self-employed persons as well as many other workers not brought in before. The professions, including engineering, were excluded by specific designation. The same legislation also revised the benefit scale and provided for a new schedule of tax rates to finance the program. The latter were important developments, for they were the first moves in line with what has become the trend of thinking on the Act — to make it self-supporting and end federal grants to the states.

### Five-Year Study

What is of interest in the 1950 amendments, aside from their reshaping of the Social Security Act, is the thinking and preparation that led to their enactment as legislation. The five-year study that preceded the legislation indicates how the feeling was growing that genuine security must be put into a national Social Security program.

The study began in 1945 when the House Ways and Means Committee appointed a group to get together the facts. The group reported to the Committee the next year. With this background, the Senate Finance Committee in 1947 authorized an advisory council on Social Security, headed by the late Edward Stettinius, and in 1948 the council brought out four reports covering various phases of the Social Security Act. On the basis of these reports, the Administration sponsored two bills, on which committee hearings were held in 1949. And from these lengthy studies and deliberations came the 1950 amendments. This series of events is important in that most of the members on the House Ways and Means Committee and the Senate Finance Committee who were on those assignments are still on the committees. Their joint comment in reporting on the 1950 bills reflects a view still held, basically, and can be examined for clues that might tell how new Social Security proposals will be evaluated.

### Proposed Revisions

The Administration proposals for amendments to the Act, which have a good chance of acceptance, include such revisions as these: The maximum retirement benefit, now at $85, would become $108.50 per month. For this, more would have to be paid into the program by employer, employee, and self-employed. The present contribution schedule has the employer and employee paying 2 percent each on the employee's earnings up to $3600 of the salary, and the schedule provides that this percentage will be increased every five years until it reaches 3¼ percent for each in 1970 and thereafter. The self-employed now pays and would continue to pay the employer's contribution plus one-half of the employee's. So that where he now pays into the system 3 percent, on his earnings up to $3600, at the maximum in 1970 he would pay 3¼ percent plus one-half of 3¼ percent for a total of 4⅞ percent.

The Administration bill would increase the maximum to be reached in 1970 to 3½ percent each for employer and employee, and to 5¼ percent for the self-employed. Also, the bill would raise from $3600 to $4200 the maximum annual earnings subject to the tax.

On the proviso of earnings for the retired (the real sore point to the professions in the whole program) the Administration proposal is that the earnings test be made a flat $1000 per year. The only Congressional proposals bettering this do not help much, and there is as yet no significant move for complete removal of the earnings test. However, the pertinent Congressional committees have stressed that they welcome comment by interested groups. What can be accomplished in testimony by such groups cannot be known until it is tried. But at the same time it should be clearly understood that there is not much hope of improvement in the earnings test this year, and the consensus in positive expression is that the $1000 limitation is assured.

For the professional man who has not become acquainted with Social Security provisions because he has been heretofore specifically excluded by the law, a point of information on the system's working is that retirement benefits begin at the age of 65, on request. The earnings test then applies until the age of 75, when the retirement payments become a straight annuity.

### Data Available

These comments have touched on only the phases of Social Security that the professions might be especially concerned with. Actually the Act is made up of many programs, and to become acquainted with these and the intricate factors involved in revising any or all of them, a reading would be required of various detailed, published explanations of the Act. Of these there are brief but thoroughly adequate free booklets readily available from your nearest office of the Social Security Administration, or from the Social Security Administration, U.S. Department of Health, Education, and Welfare, Washington 25, D.C.

The Chamber of Commerce of the United States has published a booklet (or perhaps its size warrants terming it a book) titled "Improving Social Security." This costs $2, but it might be worth it, not

*—Continued on page 80*

PUBLIC POWER SOURCES OF OVER 50,000-KW CAPACITY DOT THE COUNTRY; STATE NETWORKS AND SMALLER MUNICIPALS WOULD CROWD MAP IF SHOWN. TRIANGLES REPRESENT FEDERAL STATIONS, CIRCLES ARE NON-FEDERALS.

# Fifty Years of Public Power

**ALBERT LEPAWSKY**
**University of California**

Ce exclusive

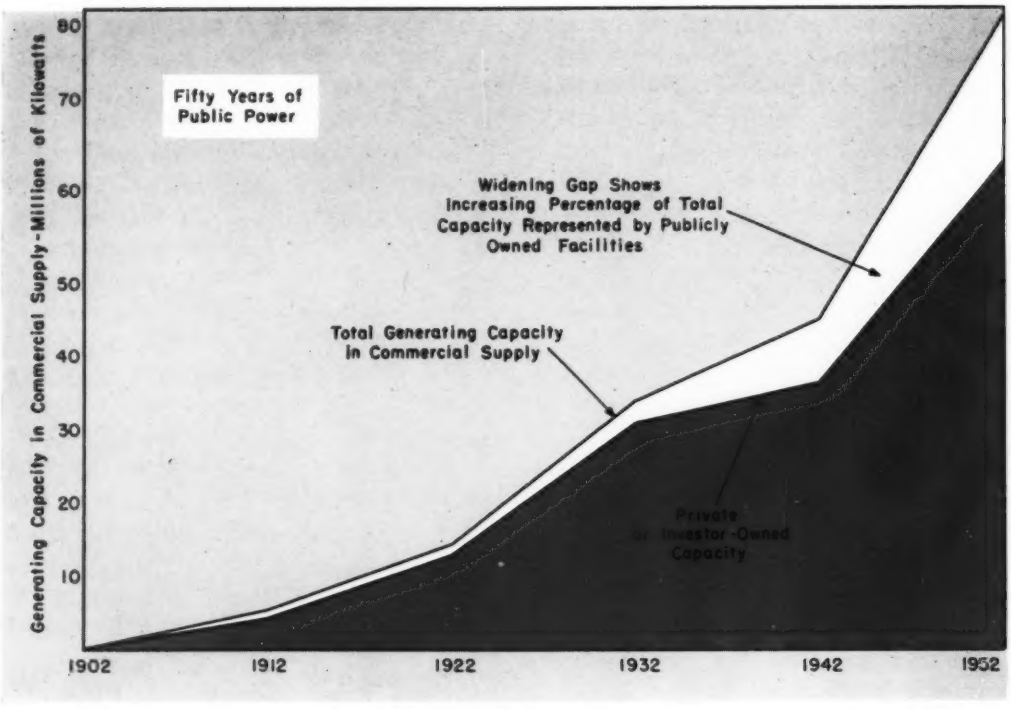
THE ELECTRIC power industry in the United States is a complex mixture of engineering and technology along with economics and politics. Every time we construct a new power plant or another giant dam, we realize that we are not merely erecting a new engineering structure but that we are also establishing another enterprise which is going to have a decided impact upon American business and government. The various elements of the power problem — the engineering, the economic, the political — need clarification, especially today when the national administration is reassessing the whole body of power policies developed during the past fifty years.

The over-all trend during these fifty years has been toward public power. Since the first Electric Light and Power Census of 1902, publicly owned generating capacity has risen from less than 10 percent to more than 20 percent of the total supply. At the beginning of 1954, the total generating capacity available for sale in the commercial supply exceeded 93 million kilowatts, of which governments owned and operated 23 percent.

### Roosevelts and Coolidge

The growth of public power was most striking during the decade following the Democratic victory of 1932. But it would be misleading to conclude that public power is the creation of the New Deal and is destined to wither away under the Republican administration. It is true, the first federal power project to sell electricity in the commercial supply was called Roosevelt Dam. However, Roosevelt Dam was named after Republican President Theodore Roosevelt, and it provided power in the area of Phoenix, Arizona as early as 1906. Roosevelt Dam has since been superceded in the Phoenix area by a still larger federal dam bearing no less a name than Coolidge Dam.

It is no accident of American history that some of




AN INCREASING PROPORTION OF THE ELECTRICAL POWER AVAILABLE IN COMMERCIAL SUPPLY IS REPRESENTED BY GENERATION IN GOVERNMENT INSTALLATIONS.

our major governmental dams are thus named after our Republican presidents. Before the New Deal, the biggest monument to public power was mammoth Boulder Dam, whose generators did not begin to whirl until the Democratic year of 1936. But Boulder Dam was actually conceived, negotiated, financed, and launched during the Republican administration of the 1920's, thanks to the diligence of Secretary of Commerce, and later President, Herbert Hoover. In fact, Boulder's rightful name is Hoover Dam; although New Deal Secretary of the Interior Harold Ickes had it renamed Boulder Dam in 1933, a Republican Congress rechristened it Hoover Dam back in 1947.

### Republicans Back Federal Power

Republicans frequently differentiate Hoover Dam from other government projects because the power generated there is sold at the bus bar to privately owned and locally owned utilities, whereas generally federal power is transmitted long distances over federally owned transmission lines and is then sold to local or private utilities by federal power marketing agencies. Nevertheless, Republican members of Congress have over the years readily joined with the Democrats in voting for federal transmission and marketing, just as they have steadily voted for federal dam construction and power generation.

Hydroelectric energy is the source for most publicly owned power — 85 percent in the case of the federal government. This is not surprising in view of the federal government's jurisdiction over the nation's river resources. Although the federal government now owns only 100 of the country's 600 hydroelectric projects, these federal projects tend to be the largest and most dramatic. They account for a third of the total hydro capacity of the country. Similarly, only about 10 percent of the country's 300,000 miles of high-tension transmission lines are now government owned and operated. But these lines carry some of our heaviest loads, and today the federal government's transmission network is beginning to resemble a national (some would call it a nationalized) power grid.

### Regional Networks

This national public power network has become especially apparent in those regions of the country where the federal government has assumed the bulk of the responsibility for power generation and power supply. The Tennessee Valley Authority, the country's foremost example of this trend, monopolizes the electrical generating and transmitting business of the Tennessee region. It operates some 30 dams and 10 steam plants. Additional steam facilities now in construction will convert it into mainly a steam, rather than a hydroelectric, system before the end of the current Eisenhower administration.

### Taft and TVA

Although the TVA is a product of the Democratic administration of the 1930's, the government's power interests in this area date back to the Republican administration of the previous generation. In 1912 the Federal Commissioner of Corporations reported to Republican President Taft that half of the govern-

ment's 23,800 "twelve-month" horsepower was being generated at the federally owned Hales Bar Dam on the Tennessee, but that since this project was then under 99-year lease to a private company, the federal government could not control it. Today, Hales Bar is one of TVA's smallest dams.

In the Columbia River Basin of the Pacific Northwest — which is six times as big as the Tennessee Valley and has twelve times its hydroelectric potential — most of the region's power is generated at federal dams under the jurisdiction of either the Department of the Army's Corps of Engineers or the Department of Interior's Bureau of Reclamation. Moreover, all of the Northwest's power is pooled and transmitted over a far-flung transmission grid, operated by the Department of Interior's Bonneville Power Administration. Through BPA the federal government exercises its responsibility for delivering power to the entire Pacific Northwest.

### Hoover and Columbia Basin

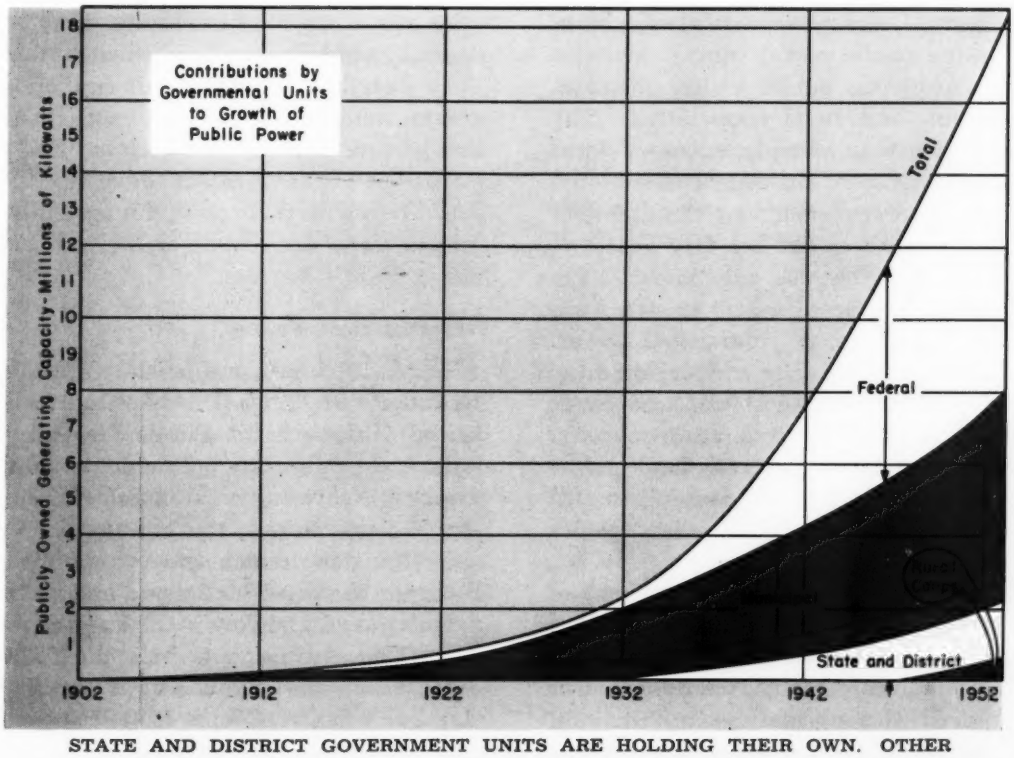
The coordinated Columbia River Power System dates back at least to March 1932, four months before Franklin Roosevelt first received the Democratic nomination for the presidency. At this time, Secretary of War Patrick J. Hurley, acting under the Republican-enacted Rivers and Harbors Act of 1925, transmitted the Corps of Engineers' survey report for the development of the Columbia Basin to President Hoover. This plan, including the giant Bonneville and Grand Coulee installations, was predicated largely upon government development, ownership, and operation of the Basin's vast hydroelectric power. The Federal government has, during the last twenty years, converted its plan into an engineering reality of unprecedented proportions.

### Missouri Going Federal

In the Missouri Valley, no single federal authority comparable to TVA or BPA has yet appeared to take over the region's power supply responsibility. But the Missouri region is twice as big as the Columbia Basin and has twice the hydroelectric potential of the Tennessee, not to speak of its enormous but untapped coal resources. Unless past trends are entirely reversed, American public management will probably try to devise new forms of public power administration here as well. Even without a TVA or BPA, the Army's Corps of Engineers and the Interior Department's Bureau of Reclamation have proceeded in the Missouri Valley with an experiment in joint planning of power resources and with government operation of the federal power projects throughout the region.

The federal government has likewise established additional generating projects, transmitting networks, and marketing agencies in other areas of the country. The Southwestern Power Administration within the Department of Interior transmits and markets the power generated at federal dams in the Arkansas, Oklahoma, and Texas areas. The Southeastern Power Administration performs the same services in the Florida, Georgia, and Alabama areas adjacent to the TVA.

In other sections of the West and South — including the Central Valley of California, the Colorado




STATE AND DISTRICT GOVERNMENT UNITS ARE HOLDING THEIR OWN. OTHER SEGMENTS OF GOVERNMENT ARE INCREASING THEIR GENERATING CAPABILITIES.

Basin, and the Cumberland Valley — the Corps of Engineers and the Bureau of Reclamation (as well as other federal agencies like the National Park Service or the Indian Service) operate federal hydroelectric projects of various sizes. In fact, there are only 14 states which don't have federal power projects; these are mainly in the New England, North Atlantic, and Great Lakes areas.

The public power trends of the last fifty years have not yet been stopped by the Republican victory of 1952. Changing government policies in individual cases — such as the Department of the Interior's withdrawal from Hell's Canyon Project in favor of private enterprise — may be significant but not necessarily decisive. Much can happen before the blasting begins on any electric power project, private or public.

For the period 1953-56, scheduled additions now being installed or already ordered for the nation's electrical public and private plant total more than 40 million kilowatts, an increase of over 50 percent above our national capacity as of 1953. And a fourth of this tremendous development is taking place at federal installations, reflecting an inevitable and continuing commitment of the 1952-1956 Republican administration to our country's public power policies of the past.

### Changing Emphasis

Should federal withdrawal from the power field become more of a reality in the near future, the cumulative effect would be felt in later years. But any over-all decline in public power is unlikely because the local segment of our public power system has demonstrated a vitality of its own during the last half century. Local power has always been the other side of the public power coin; it includes municipal power projects, public utility districts, state-owned systems, and rural cooperatives. The Republican party has now warmly endorsed local power, "public and private." This might change the emphasis without, however, modifying the direction of the public power trend of the last fifty years.

At the turn of the century, the only known form of local public power, in fact the only known form of public power as a whole, was municipal power. Until it was overtaken by the rise of federal power after 1932, local public power continued to account for over 90 percent of all public generating capacity. Even after 1932, the total amount of local public power continued to double each decade; it still accounts for almost half of our public power capacity.

Municipal power was the original stronghold of our public power advocates. Our earliest electrical census statistics quaintly referred to "municipal water wheels". Today municipally generated power comes primarily from steam and diesel installations. Present-day controversies over federal power pale into insignificance next to the heated debates over municipal power which went on up to and beyond World War I.

At present, there are some 2500 municipally owned electrical utilities. In spite of their recession in the '20's during the heyday of private utility consolidation, the municipals now generate a third of our public power. When they add to this their extensive power purchases, they are able to distribute electricity to millions of the country's electric customers.

### Big-City Power

The power systems of such large cities as Los Angeles, Seattle, Omaha, Tacoma, Memphis, Nashville, Chattanooga, and Knoxville have all been brought under municipal control. In the TVA area, all of the local distribution systems, including the rural cooperatives, have similarly come under government control. In the Columbia Basin, the trend is less extensive but no less intensive. The long-established municipal systems of Seattle and Tacoma, for example, own about a tenth of the region's high-voltage transmission mileage. Moreover, the special public utility districts of the Northwest are the strongest in the country.

The second major group of local public power authorities are the rural electric cooperatives, financed and serviced by the federal government's Rural Electrification Administration. Now totalling more than 1100, these rural cooperatives did not appear on the scene until 1936, but their growth has been rapid. They began to go into the electrical generating business in some instances during the 1940's, but they have developed only about 600,000 kilowatts of their own capacity. They are, however, enormous purchasers and distributors of power. They distribute to some four million customers, a greater number of rural customers than is served by the private utilities themselves. Should an anti-public power movement develop, the rural cooperatives with their powerful agricultural pressure groups can muster some of the heaviest bi-partisan roll calls in Congress.

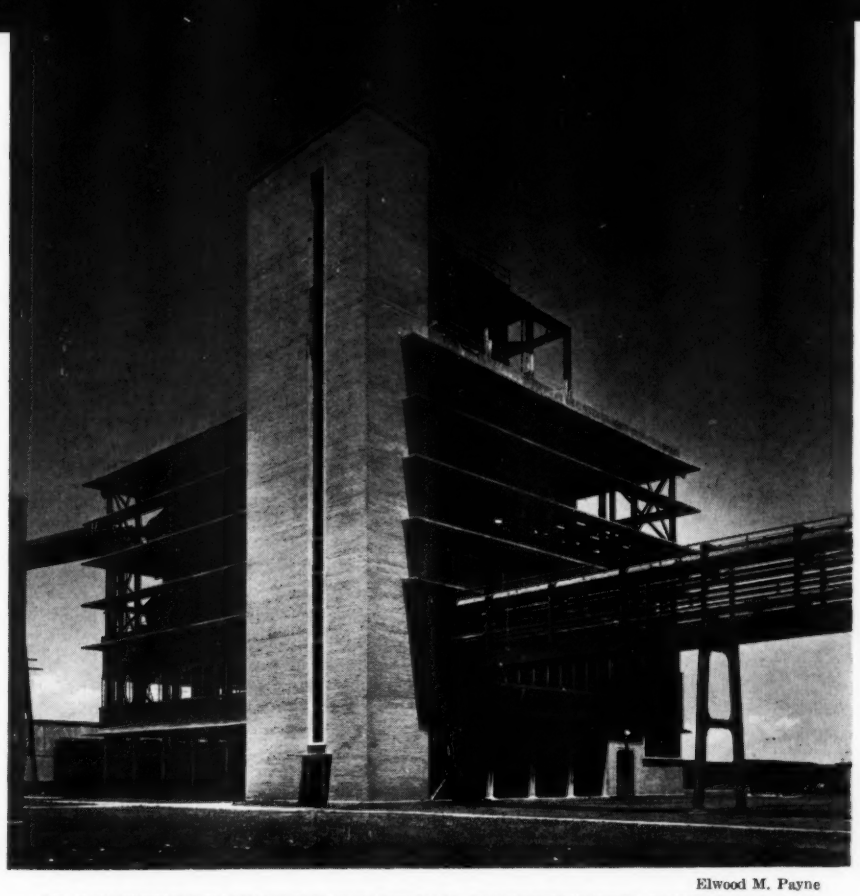
### Nebraska State System

Third and finally are the state systems which may be called our "little TVA's". One of the less publicized of these is the Public Power System of Nebraska, the only state public power monopoly in the country. Nebraska is the home of Republican Senator George Norris, the Father of TVA, and it is also the state which gave Republican candidate Eisenhower one of his largest majorities in 1952. In neighboring Oklahoma is the state-controlled Grand River Dam Authority, serving the Tulsa area.

In the supposedly conservative South is South Carolina's Santee-Cooper River Project, operated by

*—Continued on page 82*

Ce exclusive



Elwood M. Payne

AS AUTOMATION REDUCES PERSONNEL REQUIREMENTS, BUILDINGS ARE DESIGNED FOR EQUIPMENT PROTECTION RATHER THAN HUMAN COMFORT.

# Current Trends in Industrial Plant Design

**FRANK L. WHITNEY, Chief Engineer**
**Walter Kidde Constructors, Inc.**

Frank L. Whitney achieved international recognition when the Museum of Modern Art recently chose one of his latest designs as the most outstanding industrial processing facility to be constructed in the United States since World War II. Now Chief Engineer of Walter Kidde Constructors, Inc., he had over thirteen years of experience in the design of major industrial projects for a wide variety of industries while serving as Eastern District Chief Engineer for The H. K. Ferguson Company. Mr. Whitney also has been associated with the B. F. Goodrich Company.

THESE FAST-CHANGING times, which have touched every phase of industry in one way or another, have produced an axiom presently being used in the design of industrial plants. The axiom is that today's factory owners are forsaking the "ancestral corporate home," and are demanding more and more that their new industrial plants consist of the minimum amount of building required to cover a mechanical process. Translated literally, this means putting a "shell over machines."

In adopting this new concept, industrial plant designers will have to inquire as to whether the factory building is a separate entity or part of a machine process. As the trend toward plant automation continues, automatic controls will continue to replace human machine operators until eventually it might develop that buildings need scarcely be designed for human comforts, but rather for machine covers. The utilization of electronic controls and relays also may bring back verticality, thus reversing the present horizontal type design. This could leave the factory designer facing a difficult decision—whether to house the machine or the man.

In earlier days, factory buildings were designed to last fifty years, and were dignified with a sort of institutional quality. Too frequently they did last

Atlanta Paper

AMERICA'S HIGHLY ORGANIZED TRUCKING SYSTEM HAS BEEN A MAJOR FACTOR IN FAVOR OF DECENTRALIZATION.

that long, and the industry suffered accordingly.

Today, however, a factory building is thought of as a housing facility for a predetermined layout of machines and necessary personnel accommodations, and industry is prepared to enlarge it, change it, sell it, or abandon it whenever it begins to hinder the operations. A certain fluidity in manufacturing operations is expected, and designs are planned for this adjustment.

In planning a building, then, the designer leads away from institutional monumentality in favor of flexibility, expandability, and even demountability, so as to permit the building to change and grow as the manufacturing process itself changes and grows.

### Construction Materials

This new concept in the basic purpose of an industrial plant is having an influence on construction materials, and the trend appears to be away from materials which do not lend themselves to easy change or expansion.

The logical approach to this problem is a wall, such as panels, which can be economically expanded or revised as the production facility itself is expanded or revised. To serve this purpose, the old stand-by—masonry—is at a disadvantage since it is inflexible. However, manufacturers have become accustomed to this material and often prefer it because of its appearance. Also, most wall panels on the market today were originally developed as a cheap substitute building material. The effort to use them architecturally has been relatively recent, and is taking hold with some difficulty.

In spite of this problem, the acceptance of wall panels is assured. Important factors in their favor are the increasing shortage of masons and the development of newer and better panels which will demonstrate lower maintenance cost and furnish the desired flexibility and economies.

A new interest in the building market is the plastic panel. In most cases this is a corrugated panel of fiber glass mat impregnated with a resin. At the present time, it is at a disadvantage since it is not fireproof, but latest reports reveal that it is only a matter of time before this is corrected.

In many instances plastic panels will be the answer to problems which designers have been unable to solve with other types of building materials. In a chlorine atmosphere, for example, plastic is about the only material that will stand up over a period of years without considerable maintenance. The use of plastic panels will open new vistas for the architectural designer, and they will have a

tendency to change or modify the designer's thinking with respect to industrial lighting.

Masonry construction will not be completely eliminated, however. There are instances when the owner is justified in his desire for masonry. In food plants, where sanitation is not only desired but necessary, the smooth interior finish of the glazed tile wall is about the most economical construction.

### Truck Transportation

The development of America's highly organized system of truck transportation also has been a major influence on industrial plant design. Transportation factors have always determined the location and design of an industrial building and, as transportation patterns change, so do buildings.

Viewed from the industrialist's side of the desk, the availability of over-the-highway transportation has been an even more compelling factor for decentralization than the considerations of national defense. The transition of industry from the city to the country also lessens congestion and permits economies in building design—two very good arguments for dispersal.

Perhaps even more important is the present trend in distribution systems. Markets today are not confined to city concentration—they are everywhere. As the once-underdeveloped areas—the South, for example, or the West—become increasingly more important market places, industry moves out to serve them and there follows an ever-growing system of small factories, distribution centers, warehouses, service facilities, garages, and truck terminals. If, in all this development, the old-time wholesaler has all but disappeared, the complicated distribution system that is replacing him still needs buildings—more buildings rather than less, and buildings of more types and designs.

The move to the "wide open spaces" has permitted important freedoms for the planners of factory buildings, as well as for the industrialist. With a large plot available, the designer is free to accommodate the assembly line in any desired alignment, disposing his areas as he sees fit. He can place storage areas, the power plant, employee facilities, and truck docks as the process demands, and he can arrange for expansion or future changes without the restrictions of a limited land area.

MODERN WALL PANELS PERMIT BUILDINGS TO BE ADAPTED TO CHANGES IN MANUFACTURING PROCESSES.

Morton Gregory

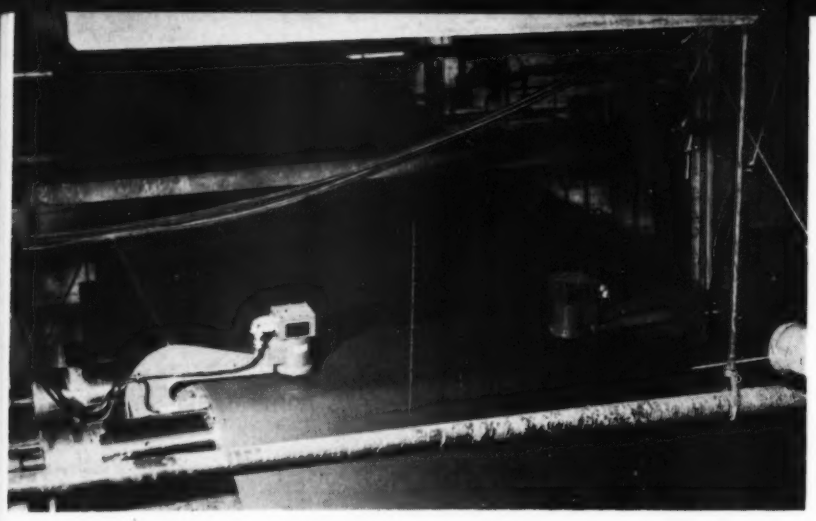
### Storage Influence

Along with the newly acquired freedoms which are relatively obvious, there are other factors influencing the trend in industrial plant design that may not be so apparent. Consider the matter of storage. In each type of plant there are individual problems of storing both the raw materials and the finished goods. These are problems that need constant re-examination. For example, coordination of delivery arrangements may cut down or virtually eliminate the areas commonly reserved for storage. It may be much more efficient to load finished products from the production line directly into carriers.

Some manufacturing plants have eliminated storage of finished goods to such an extent that they would have to shut down if outgoing transportation should be tied up even for a few days. Such an arrangement might be entirely feasible for one factory, but completely impossible for another. Thus, modern distribution systems, completely outside the plant, introduce important design considerations within the plant, particularly with respect to materials handling. These problems vary widely in different locations.

In the past decade, the architectural concept of the industrial plant has been radically revised. Industry has readily accepted the principles of contemporary architectural design and, with few exceptions, these principles have been put into full use in suburban development. The acceptance of new architectural designs has resulted largely because architectural tie-ins with existing designs were not necessary, as had been the case in the expansion of most existing urban plants.

Perhaps the greatest impetus for contemporary design are the economies it offers. The industrialist found that he could have an attractive-looking plant in the contemporary style at no additional cost and, in many instances, under an intelligent direction he could have it at a reduced cost. ▲▲



# Radioisotopes For Measuring

FOUR BETA ABSORPTION GAUGES ARE USED BY BIRD & WALPOLE TO MEASURE THICKNESS OF FLOOR COVERING.

CE exclusive

EDWIN K. LANGILLE

THE USE OF artificial radioisotopes for weighing and measuring is the first application of this startling new tool to be widely used in industry. It is the forerunner of a seemingly endless number of uses for radioactivity which now may be expected to solve hitherto insolvable problems in mills and factories.

Radioisotopes used in the beta gauge, developed and manufactured by Tracerlab, Inc., are now being used to control the uniformity of film, coatings, and sheeting in more than one-hundred plants and a variety of industries. With this gauge, the thickness of such materials as paper, plastics, linoleum, metals, and rubber can be measured to a degree of accuracy never before attained.

Its advantages are many. Since it measures without contact, it is well adapted for use on soft or delicate materials that are easily marred, and the beta rays have no effect on the material being measured. It will perform at any production speed, and an operator can detect a change instantaneously, so that sampling and reworking are unnecessary. By holding the variation in product thickness to .002 inch plus or minus instead of .004 inch plus or minus, a beta gauge has enabled Gilbert Paper Co. of Menasha, Wis., to save $150,000 yearly and increase product acceptance from 89 to 97 percent.

### Radioisotopes

Any element can artificially be made radioactive by placing it in a pile of uranium and bombarding it with neutrons. This makes the nucleus of the molecule unstable, and nuclear radiation is emitted as it seeks to return to a stable state. Radioactive material may be rented or purchased from the Oak Ridge Laboratories under regulations of the Atomic Energy Commission.

The strength and life of the radioisotope determines the element to be selected for any particular type of use. Some of the alpha rays are so weak they can be stopped by a piece of paper, while gamma rays given off by radioactive cobalt will penetrate six to eight inches of steel. Some, like Carbon-14, have a half-life of 5600 years, while others, like Iodine-131, last only eight days. Strontium-90, with a relatively weak beta ray and a half-life of 25 years, has generally been found best for use in gauges.

### Absorption Type

Two types of beta gauges, the absorption type and the backscatter type, are being used by industry to measure thicknesses. The absorption gauge may be compared to shining a flashlight through a stack of tissue paper and measuring the difference in light passing through as each sheet is added.

For many years, it had been the practice in paper mills to tear out a section of a sheet, cut it to a fixed size, and weigh it. This entailed destruction of the product and loss of raw stock, since there was no production control between test intervals.

The Strathmore Paper Company of Springfield, Mass., now uses the beta absorption gauge to maintain continuous control, and has found that it also enables operators to get "on gauge" quickly at the start of a run, thereby reducing the amount of substandard stock run off before reaching the correct tolerance.

Their equipment is mounted in a C-frame having a two-inch clearance between the source and the detector. Radioactive Strontium, contained in a hermetically sealed capsule set inside a cast aluminum mounting, throws rays up through the paper. A detector, located in the upper arm, converts the radiation passing through the paper into electrical energy which is amplified and measured.

In a similar application, Bird & Sons of Walpole, Mass., use beta absorption gauges before and after applying a sealing coat to asphalt impregnated base

stock in the manufacture of floor covering. Formerly, it was the practice to weigh completed rolls after drying. By this time, several rolls had been run off, necessitating loss or reworking when the test indicated a sub-standard product. This method also was unsatisfactory because sections within the roll could be off-weight, and yet the weight of the entire roll could be correct. In addition, there was no check available on coating unevenness due to cocked doctor blades.

Four beta gauges are used—two are applied to the edges of the base stock and two at each side of the stock after the sealing coat has been applied. A highly accurate control of coating weight has been obtained by feeding the results of the two gauges on the right into separate pens of a two-pen recorder, with a similar check on the two left gauges.

### Backscatter Type

The backscatter gauge operates in reverse to the absorption type. Instead of measuring the beta rays which go through the material, measurement is made of the rays reflected from it. Variations in sheet thickness increase or decrease the number of electrons absorbed in the material, thus changing the amount of reflected radiation.

The outstanding feature of the backscatter gauge is that the source and the detecting chamber are located in one movable unit, thus making it possible to scan an entire surface. Since both functions are performed on one side of the sheet only, it is especially adapted for use in positions where it is impractical to reach both sides of the material.

In the manufacture of waterproof footwear and rubber yard goods, Hood Rubber Company, a division of B. F. Goodrich, installed two backscatter gauges, one at each end of a calender roll. Continuous measurements of rubber thickness are indicated on two chart recorders located at the operator's station at the opposite end of the mill, thereby aiding the operator in controlling the feed of raw rubber. The charts also provide a permanent record of the material produced.

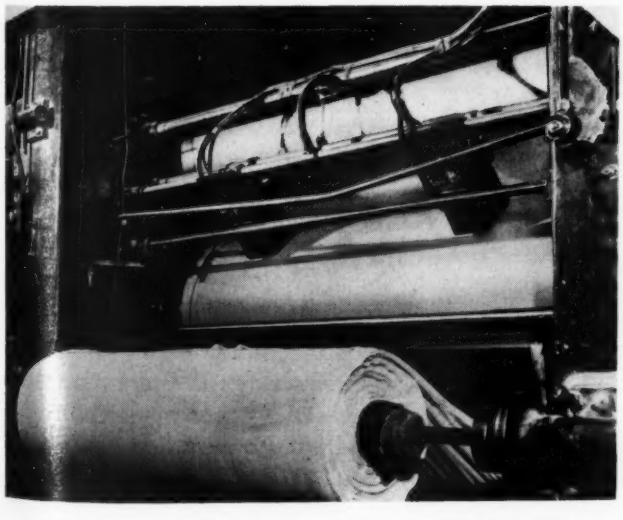
The calender operates two shifts, five days a week, at an approximate speed of twenty yards a minute, and a variation of as little as one mil may result in a large dollar savings or loss. The company has found that the beta gauge makes it practical to establish an average weight tolerance of 5 percent, plus or minus, on the finished yard goods.

### Outlook

New industrial applications for artificial radioisotopes are constantly being developed, and the possibilities appear to be limitless. Work is now in progress to perfect the use of the beta gauge for measuring wall thickness and roundness of tubing. Successful experiments have already been conducted on short pieces of tubing with the source material moved inside the tube, and the radiation measured from the outside.

Unfortunately, the development of new applications for radioactive materials is sometimes retarded by the ignorance and fear which often surrounds atomic energy and radioactivity. A Pittsburgh steel mill recently worked out a method for using radioisotopes to detect when a furnace wall was worn sufficiently to require replacement.

The idea was to embed a radioactive element in the middle of each fire brick. When the walls of the furnace wore down to this material, it would come into contact with the steel and the radioactive particles entering the steel could be detected, thus indicating it was time to build a new furnace. The masons, however, were afraid of these "radioactive" bricks and refused to handle them. ▲▲



BACKSCATTER GAUGES AT HOOD RUBBER CHECK THE RUBBER AS IT PASSES THROUGH CALENDER.

CHART RECORDERS ARE USED BY HOOD TO PROVIDE CONTINUOUS CHECK ON FEED RATE OF RAW RUBBER.

# Stiffeners for Large Air-Ducts

**PAUL ROGERS**
**Rogers & Snitoff, Inc.**

MANY INDUSTRIAL PLANTS such as power stations and steel mills require large capacity air-ducts, particularly from the forced draft fans to the furnaces. These ducts often carry air or gases under considerable pressure and must be reinforced not only for strength but also to prevent vibration.

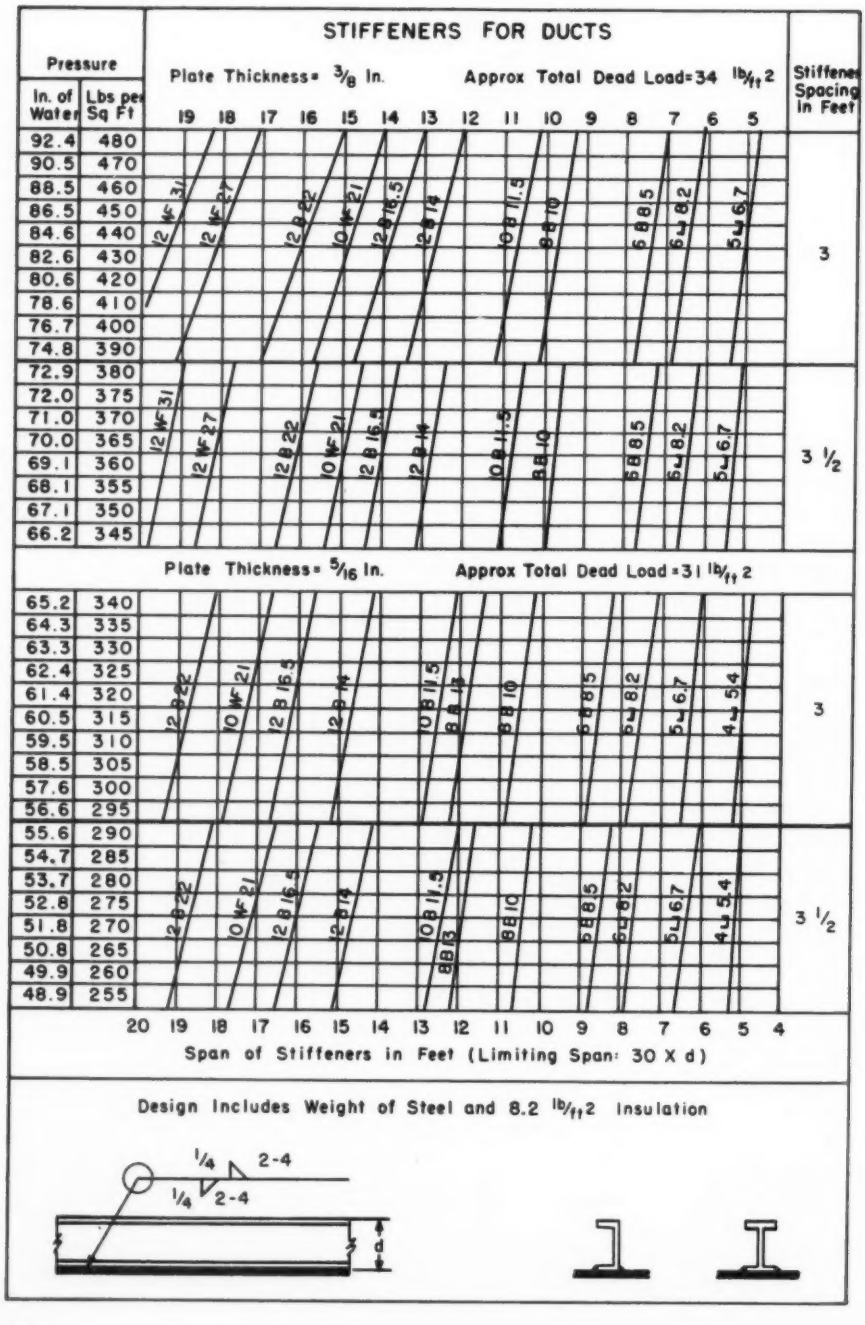
Large ducts are usually square or rectangular in cross section, and are constructed of steel plates with stiffeners as reinforcing members. The stiffeners are attached to the outside at proper intervals so as to form continuous supports.

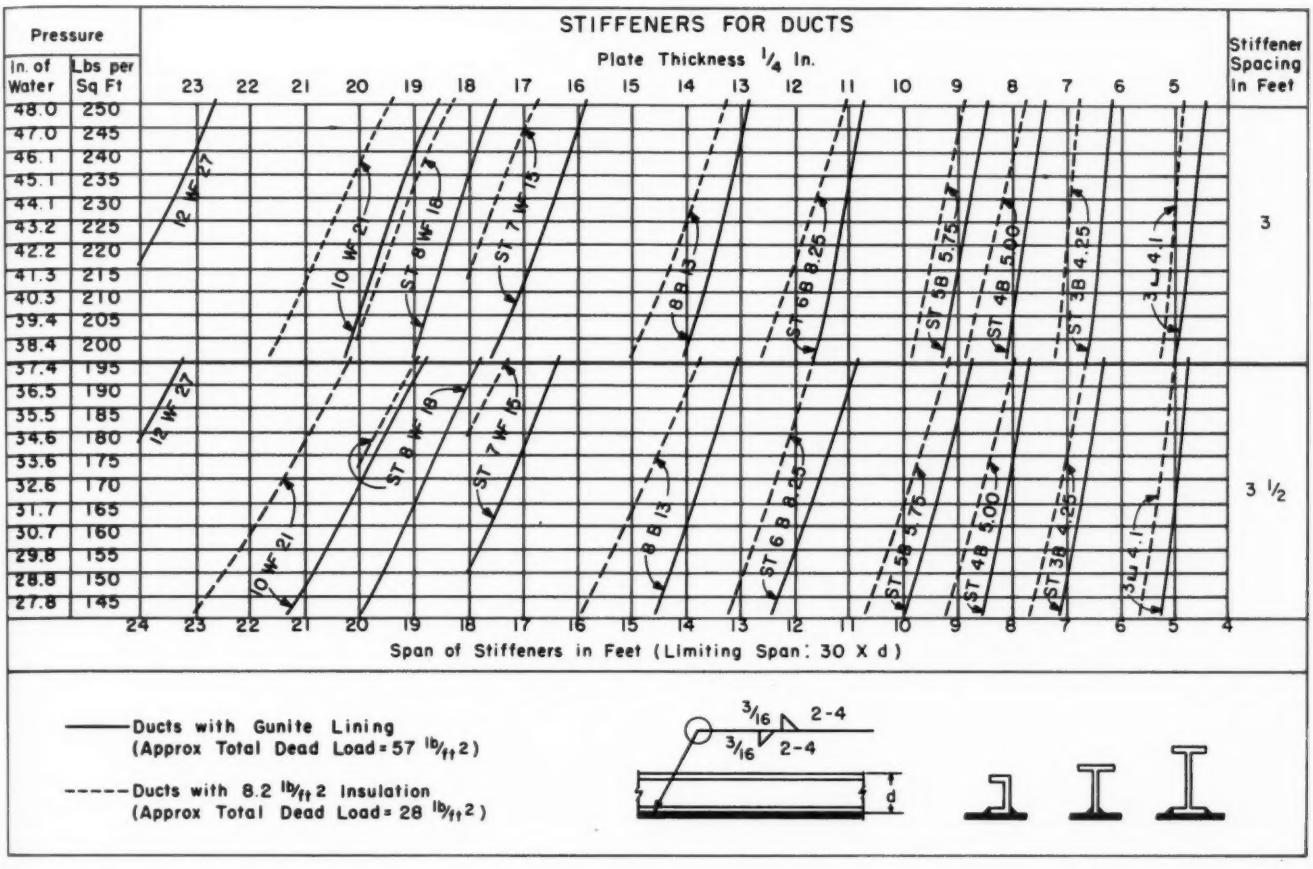
To determine the most economical design for pressure ducts, a proper analysis by structural engineers is required. Pressure within the duct is an important consideration in this analysis. Since pressure and volume vary, these calculations must be made for each installation. Consequently, charts or tables can be of considerable assistance in selecting the most economical yet satisfactory thickness for the plates, and in determining the proper size and spacing of the stiffeners.

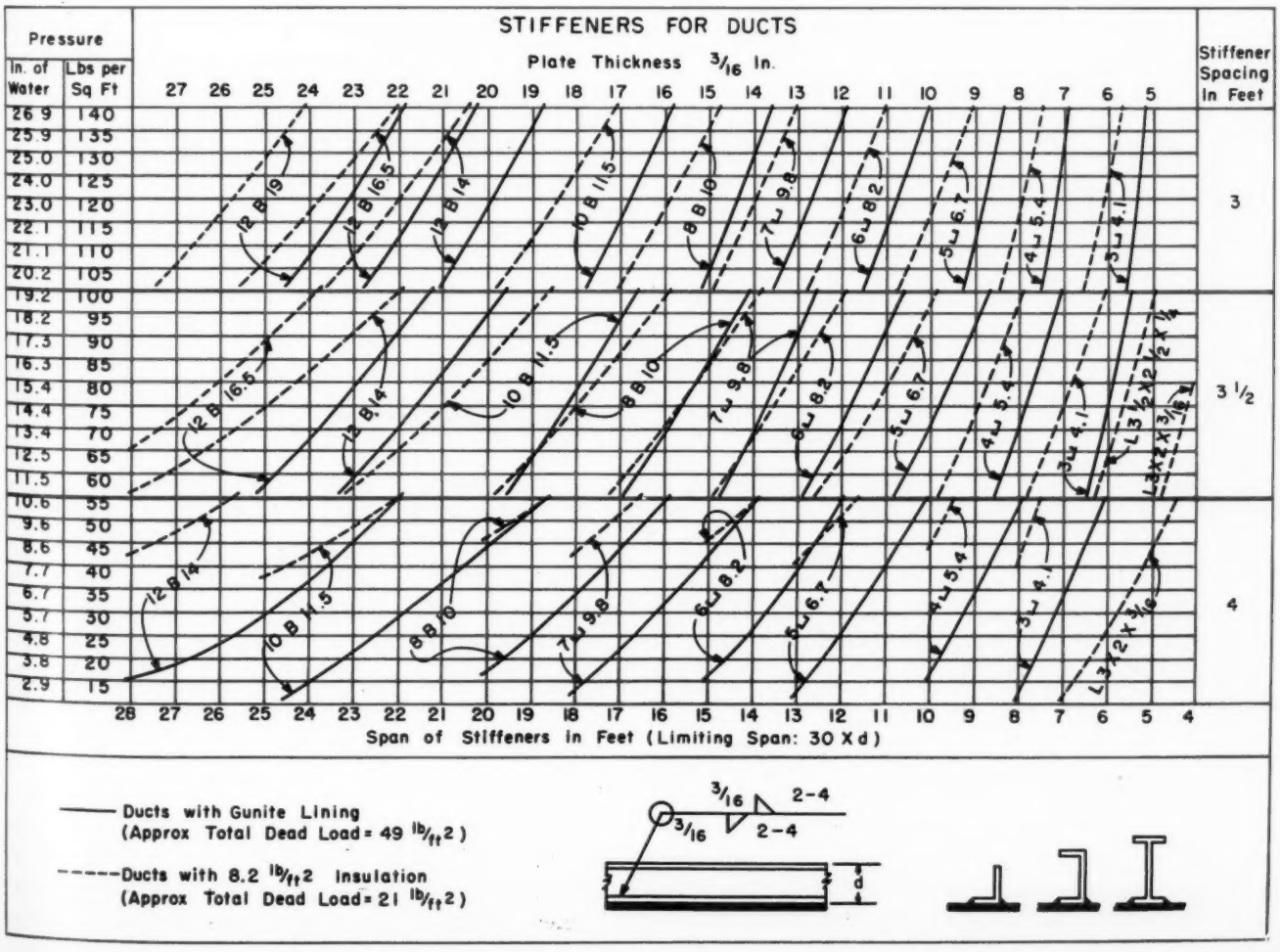
The charts presented in this article have been developed to cover an extensive range of conditions. They include ducts for pressures up to 92.4 inches of water, and for stiffener spans up to 28 feet for low pressures and up to 20 feet for higher pressures.

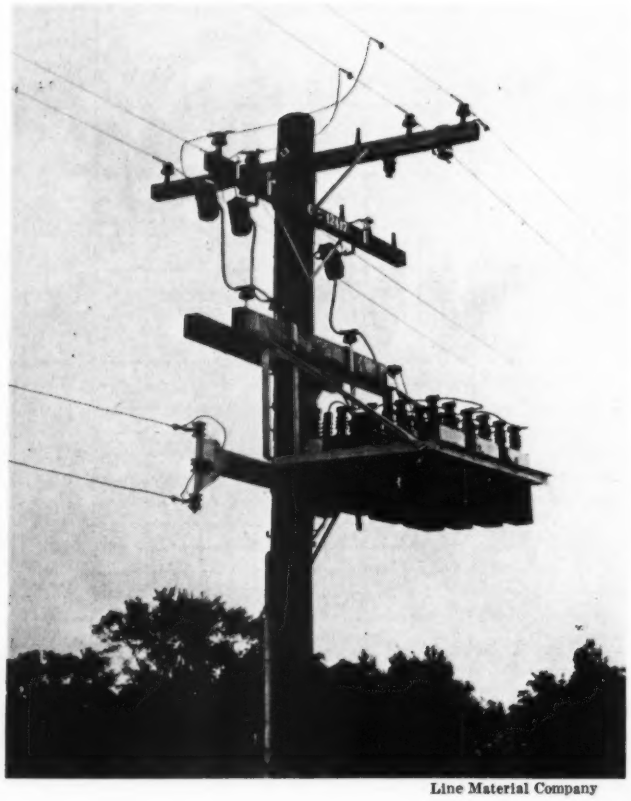
The stiffeners are designed to support the dead load of the plate, their own weight, and the weight of the insulation. Furthermore, they are designed to resist tensional forces resulting from internal pressures on the sides. Maximum fibre stress for the combination of all these forces is limited to 20,000 psi.

Designations used in these charts are the standard abbreviations recommended by the American Institute of Steel Construction. The necessary amount of welding required for the stiffeners also is specified in the tables. The symbols used are those recommended by the American Welding Society. ▲▲

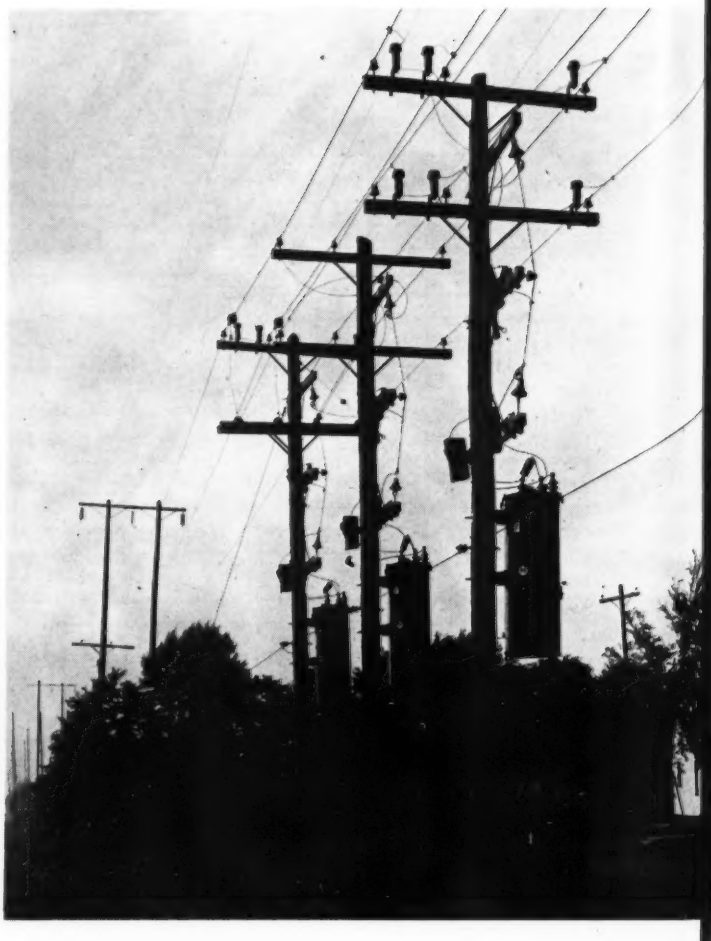



STIFFENERS FOR DUCTS
Plate Thickness 1/4 In.
Pressure
In. of Water
Lbs per Sq Ft
Stiffener Spacing in Feet
Span of Stiffeners in Feet (Limiting Span: 30 X d)
Ducts with Gunite Lining (Approx Total Dead Load = 57 lb/ft2)
Ducts with 8.2 lb/ft2 Insulation (Approx Total Dead Load = 28 lb/ft2)
3/16 2-4
3/16 2-4
d


STIFFENERS FOR DUCTS
Plate Thickness 3/16 In.
Pressure
In. of Water
Lbs per Sq Ft
Stiffener Spacing in Feet
Span of Stiffeners in Feet (Limiting Span: 30 X d)
Ducts with Gunite Lining (Approx Total Dead Load = 49 lb/ft2)
Ducts with 8.2 lb/ft2 Insulation (Approx Total Dead Load = 21 lb/ft2)
3/16 2-4
3/16 2-4
d



Line Material Company



CONSULTANTS ON UTILITY JOBS OFTEN HAVE THE CHOICE OF USING CAPACITORS (ABOVE) OR REGULATORS (RIGHT) TO CORRECT VOLTAGE PROFILES ON DISTRIBUTION LINE.

## Should You Specify

# Regulators or Capacitors

**R. D. OKERBERG**
**Transformer Department**
**Allis-Chalmers Manufacturing Company**

CE exclusive

WHETHER REGULATORS or capacitors should be specified in a particular situation is often difficult to determine, but the advantages of each generally are found in a few rules of thumb.

Any corrective device must be inoperative within a certain region or "dead band" to prevent hunting or over-correction. The size of this dead band—the band width—is a measure of the usefulness of the corrective device. The majority of feeder voltage regulators manufactured today have small 5/8-percent steps and have accurate controls capable of maintaining voltages within plus or minus one percent of a predetermined value.

The band widths of voltage-controlled switched capacitors are usually considerably larger. It is necessary to switch capacitors in relatively large increments to keep switching and control costs within economic limits. Band widths of five percent or greater result. The significance of differences in band width can be evaluated by determining the amount of load or length of line which can be regulated.

### Voltage Profiles

Examining a section of a distribution system may reveal a voltage profile similar to that shown in Fig. 1; a certain tolerance has been set between the highest voltage allowable on the first distribution

transformer and the lowest allowable on the last transformer. The band width is shown as BW-1. Fig. 2 shows the voltage profile of the same system but with a narrower band width (BW-2) and a larger voltage drop ($I_2Z_2$). The point of lowest allowable voltage is at the same distance as in Fig. 1; $D_2$ equals $D_1$. How much more load can the system in Fig. 2 carry? We find that

$$\text{Percent load increase} = \frac{(\text{Original Band Width} - \text{New Band Width}) \times 100}{\text{Voltage Tolerance} - \text{Original Band Width}}$$

Referring to Fig. 2, this equation shows how a narrowed band width (BW-2) permits a greater $I_2Z_2$, i.e., increased load.

To show how appreciable this can be, substitute some values in the equation for a system with a 10-percent voltage tolerance when the band width is changed from four percent to two percent. The possible load increase works out to be 33.3 percent. The curves of Fig. 3 show the increased loads possible when band widths are reduced to 1¼ percent (or two ⅝-percent steps) from 5-, 3¾-, or 2½-percent widths.

### Feeder Loads

Feeder loads may not always increase on a fixed feeder length, but may be increased by extension of the feeder. Again this can be made possible by a narrower band width, although a different expression determines the amount of increase permissible. To determine how much $D_2$ can increase, let $D_2$ increase while picking up additional distributed load until the voltage reaches the minimum allowable V min.

Assuming equally distributed load, the current I is proportional to the distance D as is the impedance Z; the voltage drop IZ is then proportional to the distance $D_2$. We find that

$$\text{Increase in feeder length} = \sqrt{\frac{\text{Voltage tolerance-Old Band width}}{\text{Voltage tolerance-New Band width}}} - 1$$

The curves of Fig. 4 show the possible increase in feeder lengths with additional distributed load when band widths are reduced to two ⅝-percent steps from 5-, 3¾-, and 2½-percent widths.

### Correcting Profiles

A voltage regulator can only improve or correct voltage conditions at or beyond the regulator. Capacitors, on the other hand, influence voltage conditions both behind and ahead of the installation point by changing power factor and kva. Fig. 5 shows the full-load voltage regulator installed at the midpoint. Fig. 5 also shows the full-load profile for the same feeder with voltage-controlled capacitors installed at the midpoint. Whether the profile with the regulators or capacitors is better will depend to a large extent upon the respective band widths. Evaluation can be made between the band widths of the two methods by the foregoing equations or by Figs. 3 and 4.

As mentioned before, the voltage change by capacitor control is done by changes in the power factor and kva of the circuit. The majority of such installations have been on relatively low-voltage, high-current feeders where changes in reactive drops can have a large effect. However, as distribution voltages increase, and currents and conductor sizes decrease, changes in reactive drop become less and less effective.

### Resistance and Reactance

The curves of Fig. 6 show the relative voltage drops at various power factors for resistance-to-reactance ratios from ¼ to 3/1. These curves are

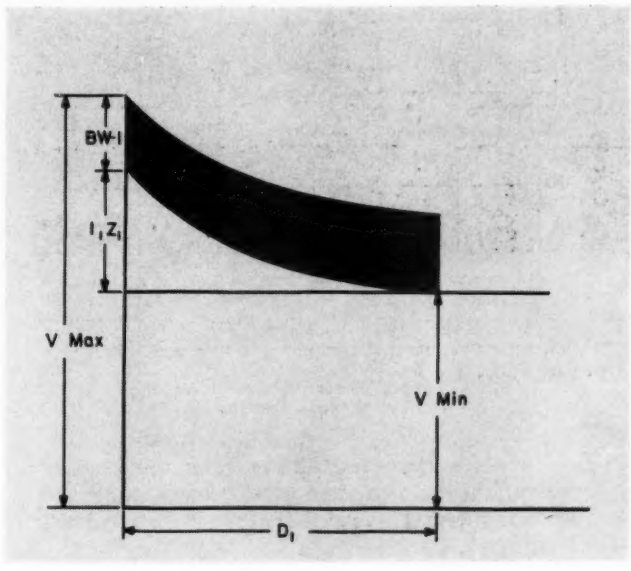



FIG. 1—VOLTAGE PROFILE OF DISTRIBUTION FEEDER SHOWS HOW LINE DROP IS MADE UP OF IZ AND BW.

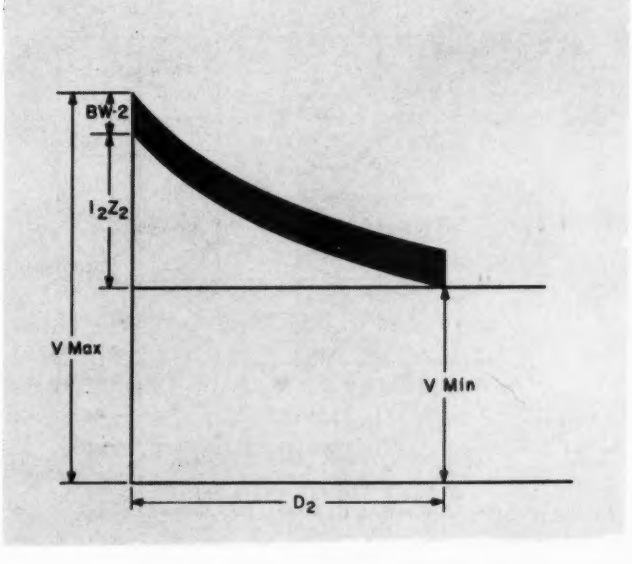



FIG. 2—WHEN BANDWIDTH BW IS NARROWED, IZ INCREASES FOR SAME LINE DROP. MEANING MORE LOAD.

based on the real portion of the voltage drop or I (R cos $\theta$ + X sin $\theta$); "R" is the line resistance, "X" the line reactance, "$\theta$" the power factor angle, and "I" the line current. The relative current has been taken as unity at unity power factor; current appropriately increases at other power factors to maintain a constant kilowatt load.

Referring to Fig. 6, curve A might be typical for a 2000-kva, 2400-volt feeder; changing the power factor from 0.70 lag to 0.95 lag changes the relative voltage drop from 5.2 to 2.3, a decrease of over 55 percent. For a feeder of the same kva at 12,000 volts the resistance-to-reactance ratio is slightly greater than 1 to 1; from curve D of Fig. 6 a change in power factor from 0.70 lag to 0.95 lag changes the relative voltage drop from 2.0 to 1.5, a decrease of only 20 percent. The resistance-to-reactance ratios as high as 3 to 1 may apply to laterals, taps, or branches of main feeders; curve G shows changes in power factor have almost negligible effect in changing voltage drops at these high ratios.

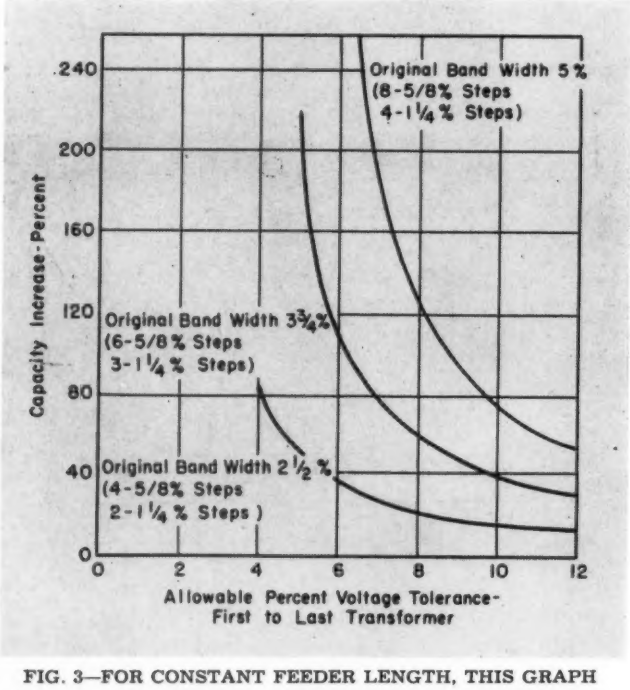



FIG. 3—FOR CONSTANT FEEDER LENGTH, THIS GRAPH SHOWS HOW MUCH THE LOAD DENSITY CAN INCREASE WHEN BANDWIDTH IS DECREASED TO 1¼ PERCENT.

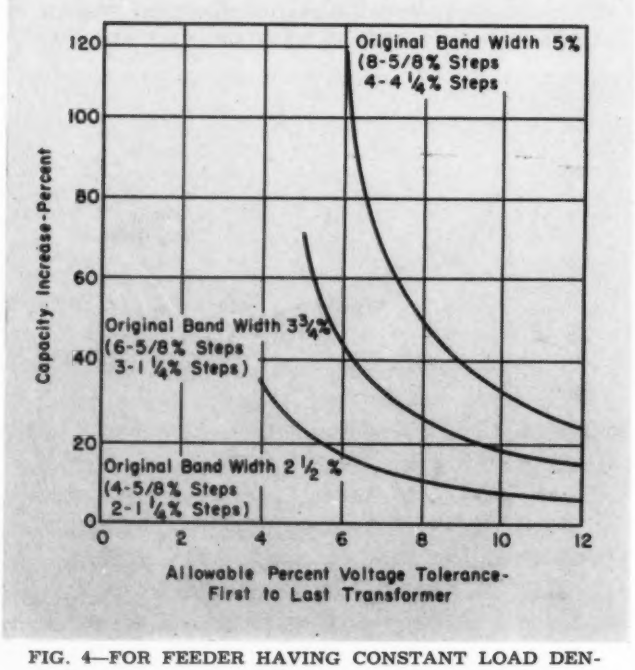



FIG. 4—FOR FEEDER HAVING CONSTANT LOAD DENSITY, THIS GRAPH SHOWS HOW FEEDER CAN BE EXTENDED WHEN BAND DECREASES TO 1¼ PERCENT.

### Leading Power Factor

The curves of Fig. 6 have been extended to take in the range of leading power factors from unity to 0.60. While system stability usually prohibits leading power factors on generators, individual feeders may operate occasionally at leading power factors. Note that for resistance-to-reactance ratios of 1 to 1 and greater, it is impossible to get voltage rises until the power factor becomes less than about 0.70 leading.

The trend today is toward higher distribution voltages. Because of the higher resistance-to-reactance ratios of such circuits, capacitor installations are considerably less effective.

As with any engineering decision, the final choice between regulators and switched capacitors is often a matter of dollars and cents. Direct comparisons can be made only for individual cases where all facts are known, but it is possible to reach some general conclusions. Since the amount of voltage change or correction by capacitors is determined by the amount of reactance through which the capacitor current flows, comparisons can be made on the basis of feeder length.

### Feeder Length

Very short feeders require a lot of capacitors, while longer feeders require less. Since the cost of a regulator is independent of feeder length, there is some point on the feeder where the cost of voltage regulation by capacitors equals the cost of regulation with regulators. For longer circuits, capacitors would be less expensive, while shorter circuits favor regulators.

For such a comparison the following assumptions are made:

¶ Installed cost of capacitors is $6.60 per kva.

¶ Substation transformer reactance is 5 percent.

¶ Present-day regulator costs used for +10 percent, ⅝-percent step regulators, single-phase, distribution-type or three-phase power regulators (plus $500.00 installation charge per single-phase unit and $1000.00 per three-phase unit).

¶ Sufficient capacitors are required to equal 10-

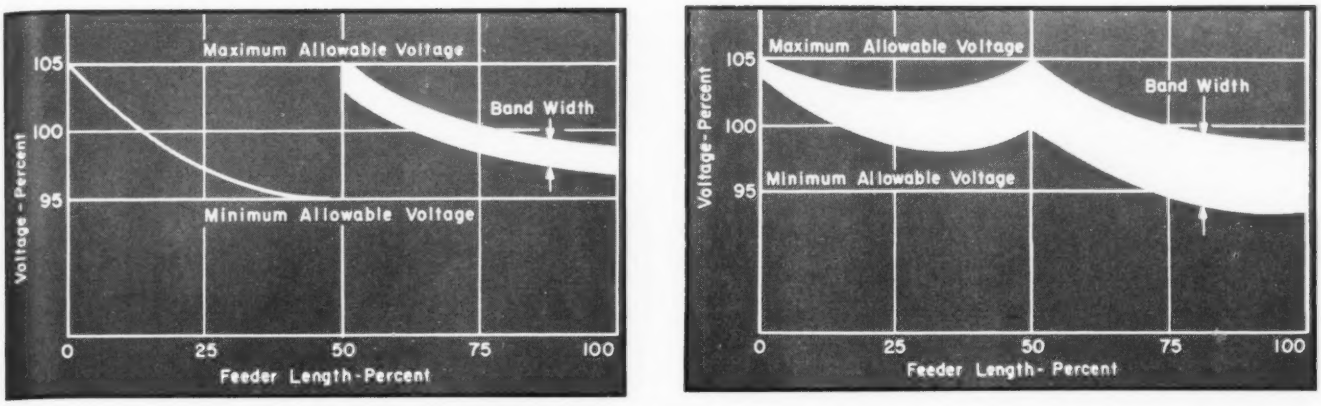



FIG. 5—HANGING A REGULATOR ON THE MIDDLE OF A FEEDER (LEFT) GIVE RISE TO A VOLTAGE PROFILE DIFFERENT FROM THE PROFILE WHICH RESULTS FROM HANGING VOLTAGE-CONTROLLED SWITCHED CAPACITORS ON AT THE MIDDLE (RIGHT); WHILE THE CAPACITORS MAY GIVE RISE TO A WIDER BANDWIDTH, THEY IMPROVE CONDITIONS BEHIND AS WELL AS AHEAD OF THEMSELVES. GRAPHS SHOW UNIFORMLY DISTRIBUTED, FULL-LOAD CONDITIONS.

percent raise of regulator (10-percent lower of regulator ignored).

¶ Conductor spacing is 30 inches for 2500 and 4330 volts, is 36 inches for other voltages.

¶ Substation transformers are connected to an infinite bus.

The results of this comparison are shown in Table 1. As would be expected, the distances are greater for higher voltage circuits where the resistance-to-reactance ratios are greater.

The data shown in Table 1 are, of course, usable only for the conditions shown. But Table 1 does demonstrate that the equi-cost distance can vary by as much as a factor of three for varying load on a line of given voltage. There are minor reversals in the lengthening of the equi-cost distances as loads decrease for a given voltage due to the way prices break in going from one equipment size to the next.

### Reduced KVA

Such a comparison, of necessity, ignores the capacitor's advantage in reducing kva demand and conductor losses. In many cases, the kva of capacitors required is great enough to cause leading power factors which might not be acceptable. Since only half the regulator range had been used and band widths ignored, the comparison is felt to be a fair yardstick.

From the comparisons of Tables 1 and 2 it is apparent that for substation regulation, voltage regulators are more economical. For feeders of the listed lengths and longer, capacitors begin to enter the picture.

### Regulation or Improvement

The final decision in many cases should be based on which is needed, voltage regulation or voltage improvement. There are some regulators which do nothing but raise the input voltage 10 percent continuously and are not really used as regulators. They probably could be replaced by capacitor installations just as well. On the other hand, many capacitor installations are used to improve voltages where regulation is actually needed.

In some cases it may be best to use both capacitors and regulators, the capacitors being used to improve power factor and the general voltage condition and regulators to give close accurate control of voltage. This is sometimes done by turning the

*—Continued on page 86*

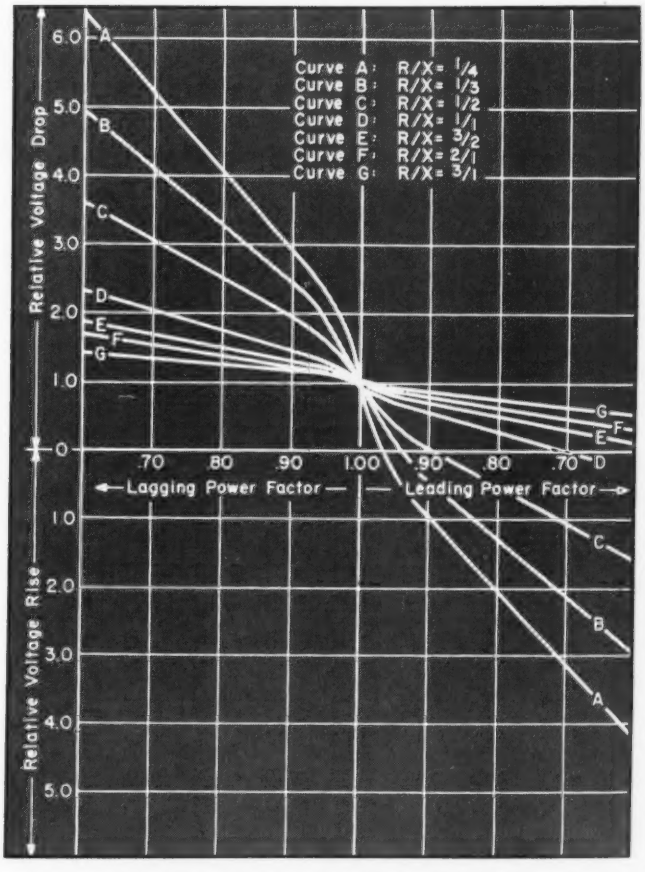



FIG. 6—RELATIVE VOLTAGE DROPS AS FUNCTIONS OF POWER FACTOR AND R/X FOR CONSTANT KW LOADS.

# NSPE For Effective Professional Action

The National Society of Professional Engineers is almost 20 years old and has over 32,000 members in 350 local chapters. It is not a technical, but a professional, organization with a membership of registered engineers practicing in many different branches of the profession.

ALAN G. STANFORD, P.E.

Cp exclusive

Alan Griffith Stanford is well qualified to author an article on NSPE, having served as a Vice-President from the Southern Zone in 1947, and as National President for 18 months during 1950 and 1951. He is a charter member of the Georgia Society of Professional Engineers, and served as its first President.

He also is a Fellow of the American Institute of Electrical Engineers, and is a Past Chairman of the Georgia Chapter. He has been a member of the Georgia State Board of Registration since 1937, and is the immediate Past President of the National Council of State Board of Engineering Examiners. A graduate electrical-mechanical engineer from Clemson College, he has been with the consulting firm of Robert and Company Associates for over 34 years, serving as the firm's Vice-President since 1945.

EFFECTIVE professional action by and on behalf of professional engineers has been the subject of considerable discussion over a period of years. Individual committees, various societies, and groups of societies have been meeting for more than twenty-five years to discuss ways and means to enhance the stature of the engineering profession.

With the increase in technology, the expanded numbers in the engineering profession, and the increased use of engineers in management and policy-making positions, a greater awareness of the professional responsibilities of all engineers has developed in the past few years. There has also been general agreement that the engineering profession is not well equipped organizationally to handle the many facets of professional development which are needed for advancement toward a more mature professional stature.

### Professional Activity

Professional activity means different things to different persons. To some, it may mean concern with ethical procedures. Others may want to concentrate on improved governmental liaison, legislative representation, enforcement of our registration laws, or better education for our future engineers. For still others, professional activity may mean concern for the utilization of engineers in the military service, or concern for the economic status of engineers. It may mean a public relations program for the profession, or it may bear reference to any one of a number of other specific activities.

Basically, however, professional activity has two objectives—an improved public service (the hallmark of a profession), and greater recognition of the professional status of engineering. These two items have certain common distinguishing features. They are the concern of all engineers, whether they be civil, electrical, mechanical, chemical, mining, or some other specialized branch. Also, they apply to the whole of the engineering profession, irrespective of whether the engineer is engaged in private practice, or employed in industry, a public utility, education, or government.

It must be admitted, however, that these two basic objectives—service to the public and professional recognition—are dependent, to a large degree, upon the practices of the individual members of the profession. The neighbors and friends of the engineer judge the engineering profession by their impression of the man they know. Professional status is not something we can singly possess—it is something that must be bestowed; and its bestowal by clients of engineering services is in direct proportion to the extent to which it is merited.

Thus, organization in any profession is merely a means of coordination and stimulation of professional activity. Such activity receives its impetus and becomes effective only as individual members of the profession will support it with their time,

their money, and their active participation.

It was on these fundamental premises that the National Society of Professional Engineers was organized in 1934. In the belief that effective professional action required the participation of individuals, the organization was based on individual membership. Furthermore, in the recognition that such activity has three major outlets for service, the Society was set up on three levels—the local chapter, the state society, and the national organization. Membership at all three levels is automatic.

The founders of NSPE believed that the organization should be composed exclusively of engineers. They recognized the very important contributions made by those associated with the engineering profession, but they further believed that in many cases the interests of these groups did not closely parallel those of professional engineers and the problem of resolving these differences would prevent the professional organization from being of maximum effectiveness in many matters. Thus, they recognized the need for an adequate definition of the "Professional Engineer."

### Registration

In 1934 it was evident that the time was not far distant when all the states and territories of the United States would have enacted registration laws, similar to those in medicine and law, which would set legal requirements for those who were to offer engineering services to the public. Since the pattern of these laws established a Board of Engineers with legal authority to review the competence of those who wished to be registered, the founders of the Society felt it unnecessary to establish another group to pass on the qualifications of candidates for membership. Thus, the qualification for membership became that of registration according to the law of any one of the states.

In the nearly 20 years of NSPE's existence, the validity of these basic premises has been borne out, and the Society now has over 32,000 members affiliated nationally through 39 State Societies and nearly 350 local Chapters. It enjoyed the greatest growth in membership of any single year in its history during 1953.

### Engineers Joint Council

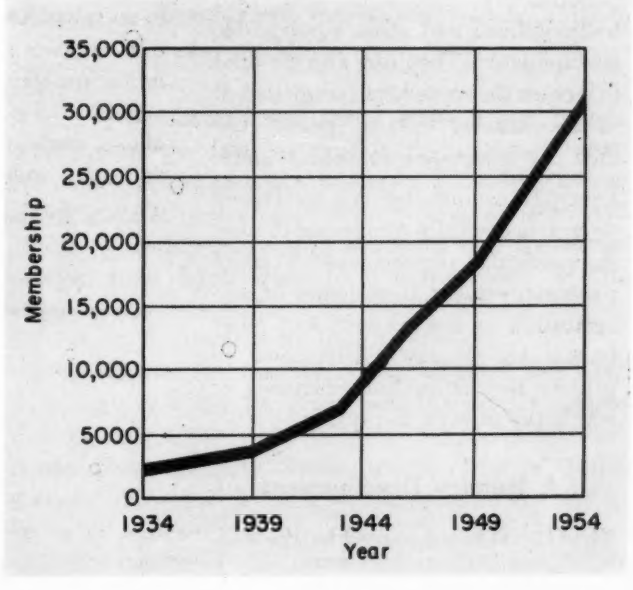
For the past several years there have been extensive discussions among representatives of the major engineering societies concerning a unity organization. It will be recalled that NSPE took the position in these exploratory discussions that, for effective professional action, the basic premises upon which NSPE was founded should be endorsed. Others in the discussions felt that representatives of the major engineering societies, acting as a somewhat loosely federated council at the national level, would be sufficient. It was on this latter basis that the Constitution of the Engineers Joint Council (previously composed of representatives of the four Founder Societies and the American Institute of Chemical Engineers) was expanded so that other organizations could be invited to participate.

In January 1953, an invitation was extended to some five additional societies, including the National Society of Professional Engineers. This invitation was very carefully considered by the NSPE over a period of nearly a year—it was debated extensively by state societies and local chapters and, at the Fall Board Meeting of the Society in November 1953, the EJC invitation was declined.

NSPE's action reiterated the original philosophy of the Society, emphasizing the failure in the council type of organization to provide means by which the direction of professional policies by individual members through their appropriate representatives could be attained; failure to establish an effective three-level medium of implementing professional programs; and failure to provide authority for the organization to act on behalf of its members. It was felt these limitations would prevent the Engineers Joint Council from being the best medium for effective professional action on behalf of the engineering profession. At the time, however, the hope was expressed that close coordination of activities and a high degree of cooperation would exist between EJC and NSPE on all matters of mutual professional development.

The aggressive program in which NSPE has been extremely active will be continued. Having its headquarters in the Nation's Capitol, and being very much concerned with national legislation and affairs, the Society will continue to review major

*—Continued on page 84*



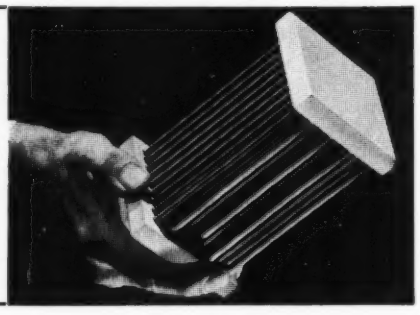

MEMBERSHIP CURVE REFLECTS RAPID GROWTH OF THE NSPE, ESPECIALLY DURING THE LAST TEN YEARS.

**AT LAST...**

# *The Effective, Realistic Answer to the Problem of Industrial Air Pollution*

## —THE HOUDRY OXYCAT—

*The industrial Oxycat. These catalytic units, used in varying numbers according to the engineering requirements of the particular installation, eliminate 95% or more of all combustible contaminants in an exhaust stream.*



Now a new concept of air pollution control offers industry the most effective, most practical means, ever developed for taking the initiative in this critical problem.

This new concept is the elimination of air pollutants by catalysis. The instrument for effecting it is the Oxycat.

Oxycats are catalytic units. Properly installed, they oxidize — by catalytic reaction — harmful and irritating waste gases in an exhaust stream at temperatures far below their normal ignition points. They can thus end air pollution by eliminating dangerous hydrocarbons and other combustible contaminants. They can also be used to recover the waste heat energy locked in unconsumed exhaust gases. And they can sometimes do both at once.

Every Oxycat installation is specialized — each is carefully engineered to meet the particular requirements. Type of pollutants present, their degree of concentration in the exhaust, and other factors are precisely determined to achieve the tremendous efficiency of which the catalyst is capable.

### A Houdry Development

The Oxycat was invented by the well-known scientist, Eugene J. Houdry. It was he who developed the catalytic process for cracking petroleum. To say that the Oxycat is one of his most important contributions in the field could be less than the full truth. It may well be among the most outstanding innovations of the century.

### Already in Wide Use

The Oxycat has been thoroughly tried and fully proven. Tests on actual industrial installations by the Pennsylvania Bureau of Industrial Hygiene, according to its official published reports, and by the Research Institute of Temple University have shown conclusively that Oxycats remove 95% or more of all combustible contaminants in an exhaust stream. In actual operation, Oxycats are now solving air pollution problems in oil refineries, in metal decorating and wire coating plants, and in the steel, chemical, food and other industries.

And in designing new plants and installations, Oxycat units now available as part of original equipment give you a sure, effective means for avoiding air pollution altogether. Furthermore, in many cases, Oxycat installations make important fuel savings.

Wherever you must tackle the problem of industrial air pollution, investigate Oxycats. Oxycat engineers are available for consultation, and to work with you closely during installation. Write on your business letterhead for complete information now.

**PARTIAL LIST OF INDUSTRIES FOR WHICH OXYCAT INSTALLATIONS ARE AVAILABLE**

| | |
|---|---|
| Asphalt | Linoleum |
| Brake lining | Meat rendering |
| Carbon black | Metal coating |
| Chemical | Oil refining |
| Coke and charcoal | Powdered metals |
| Cork | Printing |
| Fabric coating | Steel |
| Fish processing | Synthetic fabric |
| Food | Textile finishing |
| Insulation coating | Varnish |

Wire coating

Municipal and industrial incineration

**OXY-CATALYST, INC.**

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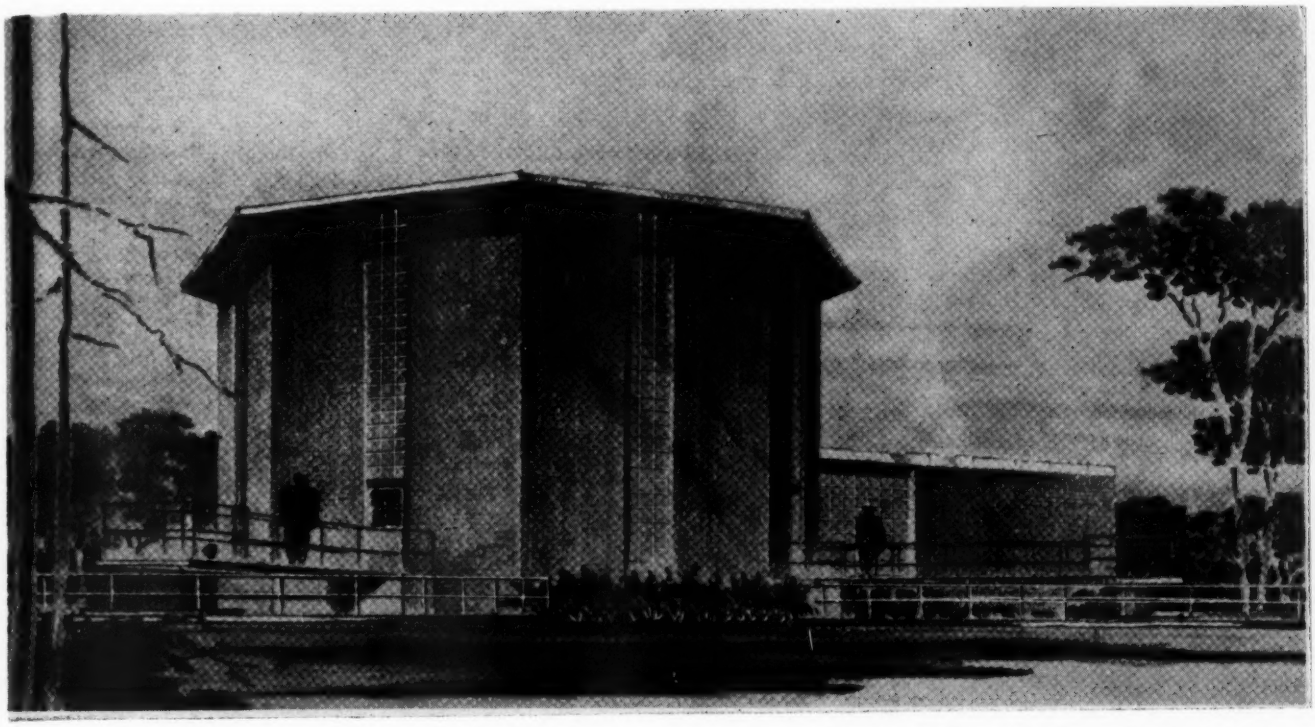
*MANUFACTURING • ENGINEERING • RESEARCH*

Fume elimination processes and equipment for internal combustion engines—for incinerators—for consumer products—and for industrial air pollution control and heat recovery



PROPOSED DESIGN FOR CHEMICAL CONTROL BUILDING BY ALBERT KAHN. FOUR 35-FT DIAMETER CIRCULAR CLARIFIERS ARE LOCATED ON THE OUTSIDE OF THE BUILDING OPPOSITE ALTERNATE FACES OF THE OCTAGONAL STRUCTURE.

# A Program of . . .

CE exclusive

# Stream Pollution Abatement

**HARRY D. UNWIN, Albert Kahn Associated Architects and Engineers**

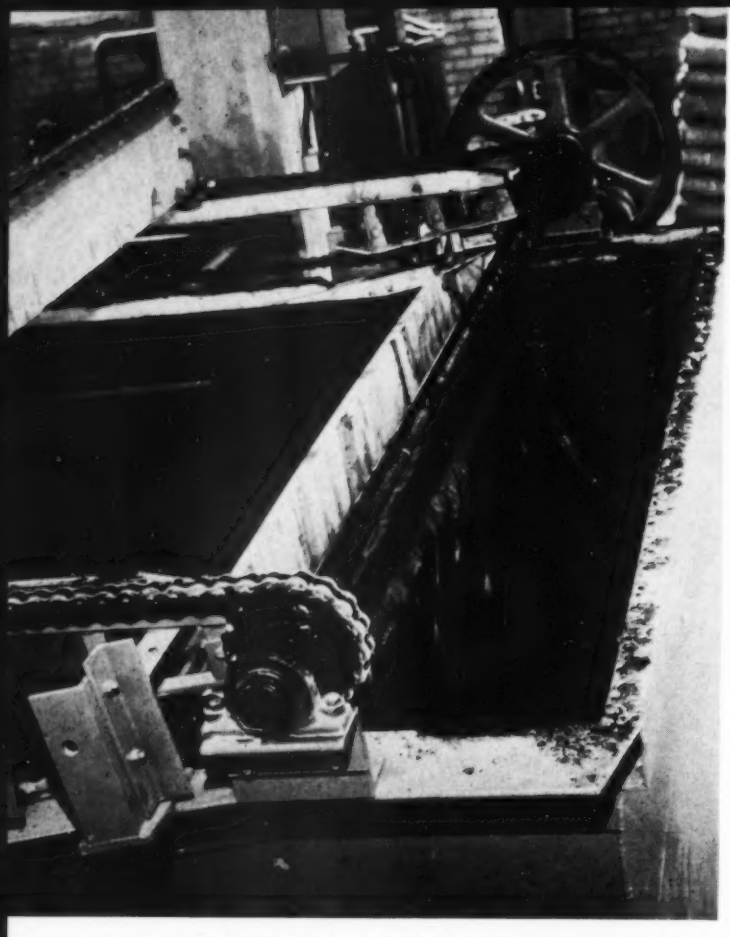
FEDERAL LAW recognizes the states as having priority over the control of water pollution. By coordinating the activities of all the agencies and organizations within a state toward a practical standard or objective, a workable program can be developed. Where several states contribute toward the control of pollution of a common stream, a high degree of cooperation between these states is required. Such groups as the Ohio River Valley Water Sanitation Commission, the International Joint Commission, and the Commission for the Coastal Waters of Connecticut, New Jersey and New York are examples of cooperating organizations.

## Stream Standards

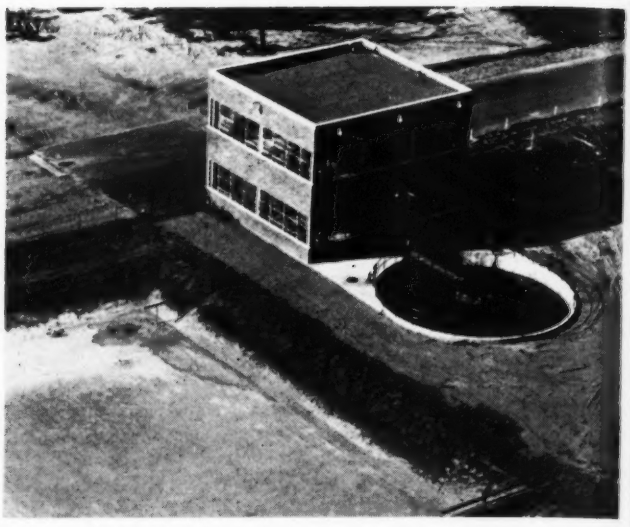
The subject of standards for stream control always reverts to the original premise that the stream must be maintained in a proper state of purity to render it fit for a specified use. New York State, having undertaken the task of establishing stream standards, has shown a common-sense attitude. Instead of attempting to segregate the streams on the basis of size or ability to receive sewerage and industrial wastes, they have tried to classify them on the basis of use; such as drinking water, bathing, fishing, industrial, navigation, and waste disposal.

Definition of the quality of the water under each classification must be given careful consideration. Unless this quality is properly determined, the entire program may defeat itself since it could prevent industry from erecting plants in highly desirable areas.

Any program of stream control must maintain an economic and realistic balance between the cost of industrial waste treatment and the desired quality of the water in the receiving stream. When the ratio



TROUGH AT TAKE-OFF END OF FLOTATION EQUIPMENT FOR REMOVAL OF EMULSIFIED OILY WASTES FROM EFFLUENT.



WASTE TREATMENT BUILDING WITH 40-FT DIAMETER CLARIFIER. THE SLUDGE LAGOON IS IN THE FOREGROUND.

of high quality water required by manufacturing operations to the volume of contaminated wastes to be discharged is large, it may be more economical to locate the plant near such a desirable water supply and absorb the cost of treating the process wastes as part of the price to be paid for this convenience.

The next step is the establishment of an effective program of waste control within the industrial plant. This should be under the direction of top management officials; at least the individual designated to supervise this activity should be responsible solely to the plant manager. In multi-plant corporations, there is a growing tendency to appoint an individual to the post of "Supervisor of Sanitary and Industrial Waste Activities" who has sufficient authority to establish local plant programs in accordance with a centralized policy. This method of organizing the stream pollution abatement program has paid considerable dividends by avoiding duplication of effort and by capitalizing upon the experience gained in the various divisions of the corporation.

There is a strong similarity between water treatment practice and the treatment of industrial wastes. For example, the equipment functions for treating oily wastes, cleaners, and plating wastes in metal-working plants, are the same as those required for the treatment of a public water supply: settling, sedimentation, and coagulation.

With this thought in mind, the organization of a plant waste control program can begin with one man assigned to the task of eliminating leaks from fixtures, wasteful use of cooling water and rinse waters when production operations are stopped; and to the deposition of liquid wastes in a definite place instead of dumping them down the nearest manhole or catch basin. These wastes can come from the washing-down of factory floors around oily operations, the cleaning out of paint spray booths and caustic tanks, the changing of coolants and cutting oils in machine tanks, and from many other operations in the plant.

As the waste control program is extended, it may encompass the segregation of different types of wastes so as to separate cyanide-bearing waters from acid wastes, oil and alkali emulsion wastes from plating wastes, and uncontaminated cooling water from all other types of waste discharges. This procedure will often enable the wastes to be treated in small batches and the clarified effluent to be discharged into the storm sewer without harmful effect to the receiving stream. In medium-size and large plants, the waste control program will be more extensive as the quantity and variety of process wastes are increased.

### Recovery of Effluents

The possibility of reducing the quantity of wastes should first be considered, then reclamation and reuse of waste waters, either before or after treatment, should be evaluated. Only after these two possibilities have been exhaustively investigated should methods of treating the wastes for satisfactory disposal to the storm sewers and streams be contemplated.

Too much time is being devoted to treatment of wastes for disposal rather than to the elimination of the need for waste treatment plants. The re-

THIS STRING-TYPE TAKE-OFF IS USEFUL FOR TREATING WASTES WHERE THE SUSPENDED SOLIDS CONTAIN OIL.

covery and reuse of spent process effluents are far more important than the devising of methods to prepare the wastes to meet anti-stream pollution requirements.

In designing an entirely new plant on a new site the handling of industrial waste problems is no different from the solution of similar problems in an existing plant. However, it is always necessary to estimate the quality and quantity of the expected wastes. Allowances must be made for future expansion; adequate sewers must be provided for segregation of all wastes requiring separation, either because of their toxicity or because it is desirable to use one waste to treat another waste.

For the medium-size and small plant, and to some extent for the large corporation, it has sometimes been found expedient to retain a consultant. A few years ago, a prominent engineer told me that he could not spare his plant engineering personnel to design a waste treatment plant when they could be far more profitably employed on design and production engineering problems, particularly since they had no experience in the art of treating industrial wastes and would, in all probability, never be required to design another similar plant.

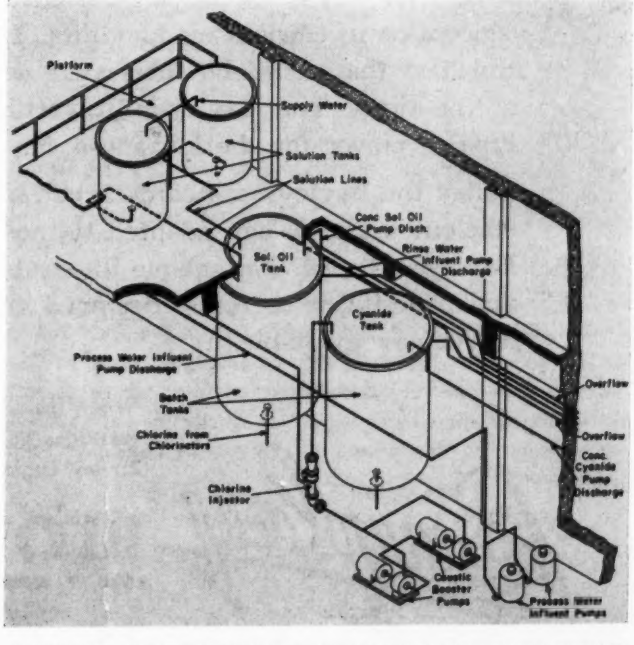
The consultant can also assist his client in the plant survey and in obtaining the basic design data. Instead of bringing into the plant a staff of technicians for surveying the waste-treating facilities, he can direct the plant personnel in the procurement of the necessary data. The plant chemists can analyze the various waste samples, and the plant engineering office can locate sewers and waste outlets. All of this data can then be revised by the consultant and a study made of the several methods available for handling the wastes. If conservation and reclamation measures are either uneconomical or impractical, then proper treatment facilities for disposal of the wastes must be designed.

Having ascertained the types, volumes, and characteristics of the various wastes, the next step is to confer with local stream control authorities. The problem can be discussed to ascertain the degree of treatment required to satisfy the objectives, or so-called standards, of effluent discharge for the particular receiving stream. A representative of the client and the consulting engineer can go over the proposed project together with the local and state enforcement agencies. This cooperative attitude on the part of all parties generally results in a mutual agreement as to the extent of treatment required. The engineer proceeds to complete the details of his design which is later submitted for final approval to the proper authorities.

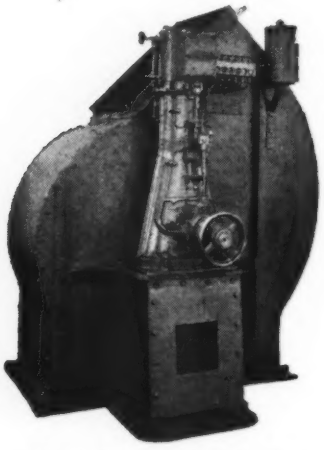
### Vendors

There is one more group essential to the complete development of a successful stream pollution abatement program—the many equipment manufacturers' representatives. These vendors can render valuable service to all parties concerned. It is important that the equipment supplier delivers the equipment to the owner or erecting contractor without delay because the control commission or approving authority has usually placed a time limit upon the starting of the new treatment works.

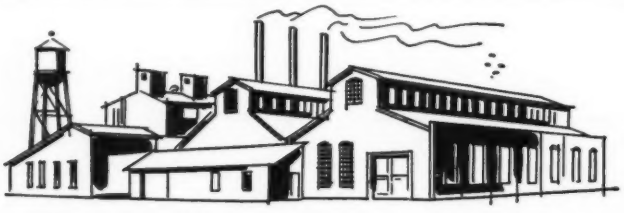
As emphasized in my address before the Engineering Society of Buffalo, N.Y. on April 15, 1954, the accomplishment of a stream pollution abatement program requires the utmost in cooperation by each individual and group. In the last analysis, it is the community of effort that will achieve this goal. ▲▲



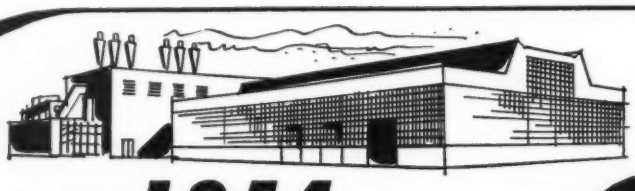

CHEMICAL SOLUTION TANKS FEED BY GRAVITY TO TREATMENT TANK. CHLORINE HELPS REDUCE TOXIC WASTES.



Early Model of BAYLEY Forward-Curve Steam Driven Fan.

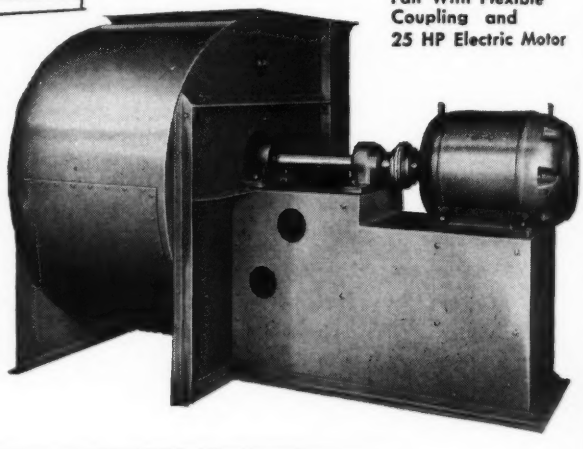


# Bayley Among The "FIRST" IN FAN DESIGN BACK IN 1914



## ...IN 1954

## OUT FRONT AS ALWAYS IN AIR HANDLING EQUIPMENT *Designed for Today's Faster Tempo...*



Bayley 445 Aeroplex Fan With Flexible Coupling and 25 HP Electric Motor

**BACK IN 1914,** the Bayley-designed forward-curve fan was a pioneer conception in efficient air handling. Its riveted and bolted housing was the sturdiest that could be fabricated with the construction techniques of the time. The Bayley-built vertical steam engine offered the best type of power for the low-speed fan drive.

Today the Bayley *backward-curve* fan represents the highest in efficient wheel design adapted to modern air handling demands. The Bayley Type AP Fan, above illustrated, with its all-welded housing and pedestal, is correctly designed and proportioned for the higher speed drives now available.

When installing fan equipment, be sure you get *all* the advantages of truly modern air handling methods. Consult the Bayley Engineering Department.

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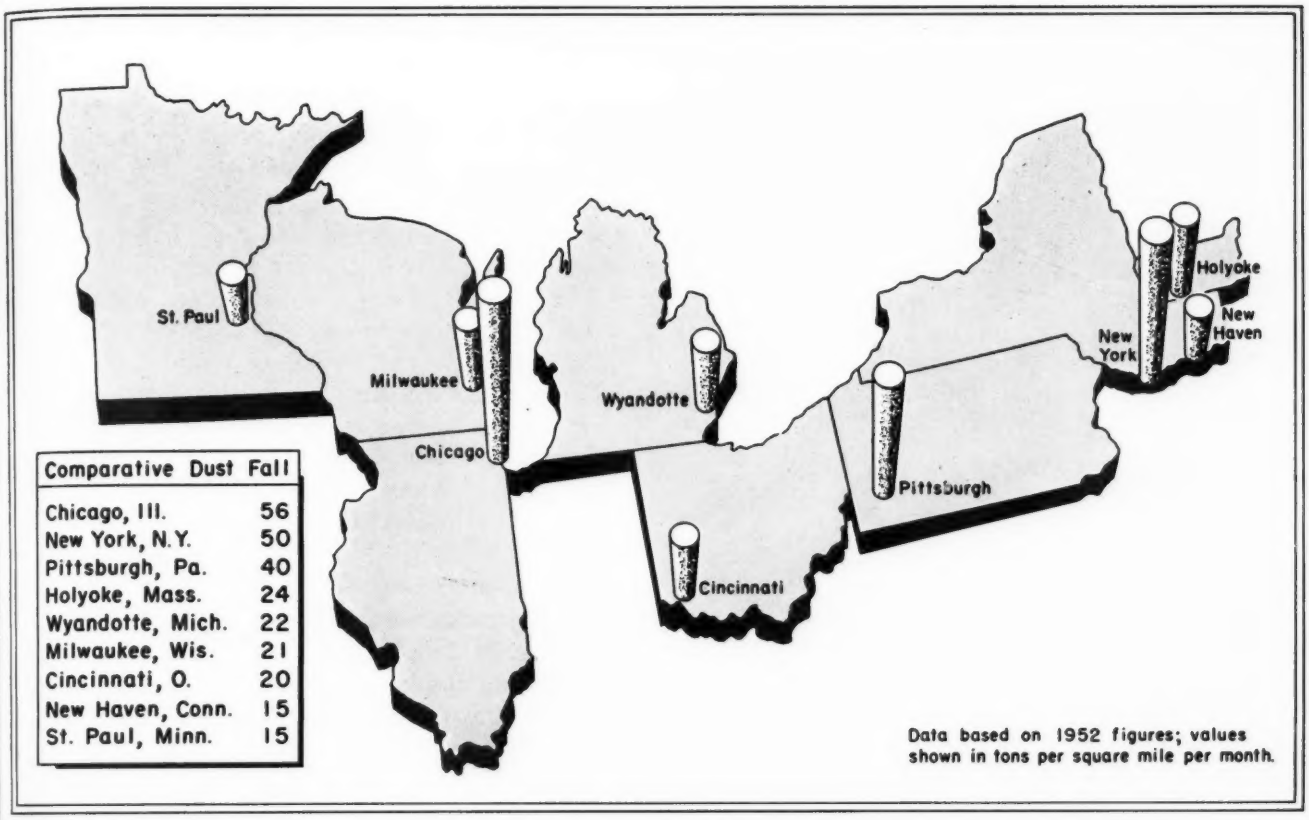



DUST FALL DATA FOR SOME MAJOR AMERICAN CITIES SHOW CHICAGO HAS GREATEST PROBLEM. DATA ARE ONLY APPROXIMATELY COMPARATIVE SINCE SAMPLING AND ANALYSIS TECHNIQUES ARE NOT STANDARD AMONG CITIES.

# Industrial Dust Hazards

CE exclusive

**MAURICE KAYNER**
**Industrial Hygiene Consultant**

Mr. Kayner has been chief analytical chemist at Armour Research Foundation for eight years. He had full charge of the analytical work on dust fall data on the Foundation's public service project for the City of Chicago. In addition to five years' experience with chemicals manufacture, he was industrial hygiene engineer for the Illinois State Department of Labor for five years and was toxicologist in the Cook County Coroner's Laboratory for a similar period.

DUST IS A GREAT industrial health hazard. Damage to the respiratory system through the inhalation of dust and through poisoning by toxic dusts causes more workmen to become incapacitated than any other industrial health hazard.

Although inhalation of such dusts as silica and asbestos may cause serious diseases (silicosis and asbestosis), most inorganic materials inhaled in the form of dust do not cause degeneration of the lungs and cause little or no disability. All dusts do, however, cause discomfort and are very disagreeable when heavy concentrations are breathed.

In general, airborne dusts are dispersions of solid materials in air. These particles range in size from less than 1 micron (0.000001 meter or about 0.025 inch) to 150 microns. The finest dust is smoke, the average particle size being only about 0.25 micron.

Whether dust will cause lung injury depends, to a large extent, on its particle size; only dust particles under about 10 microns are inhaled and reach the lungs. Dust particles less than about 20 microns in

THIS MICROPHOTOGRAPH OF CHICAGO DUST SAMPLE SHOWS FIBERS, FEATHERS, FLY ASH, AND SOOT.

size are invisible to the naked eye but can be seen by reflectance from a strong light. This effect is apparent when a strong beam of sunlight is observed against a dark background.

The concentration of dust in the air is very important. Low concentrations cause no noticeable damage to the lungs. In fact, even large quantities of dust take a long period of time—actually years of exposure—to cause real damage. Then, only certain types of dust prove harmful. Silicosis, the most serious lung disease caused by dust, rarely occurs in less than five years of exposure to a heavy concentration of fine silica dust. The United States Public Health Service has set a limit for safe exposure to silica dust of 5 million particles per cubic foot of air, each particle of the silica dust being under 10 microns in size.

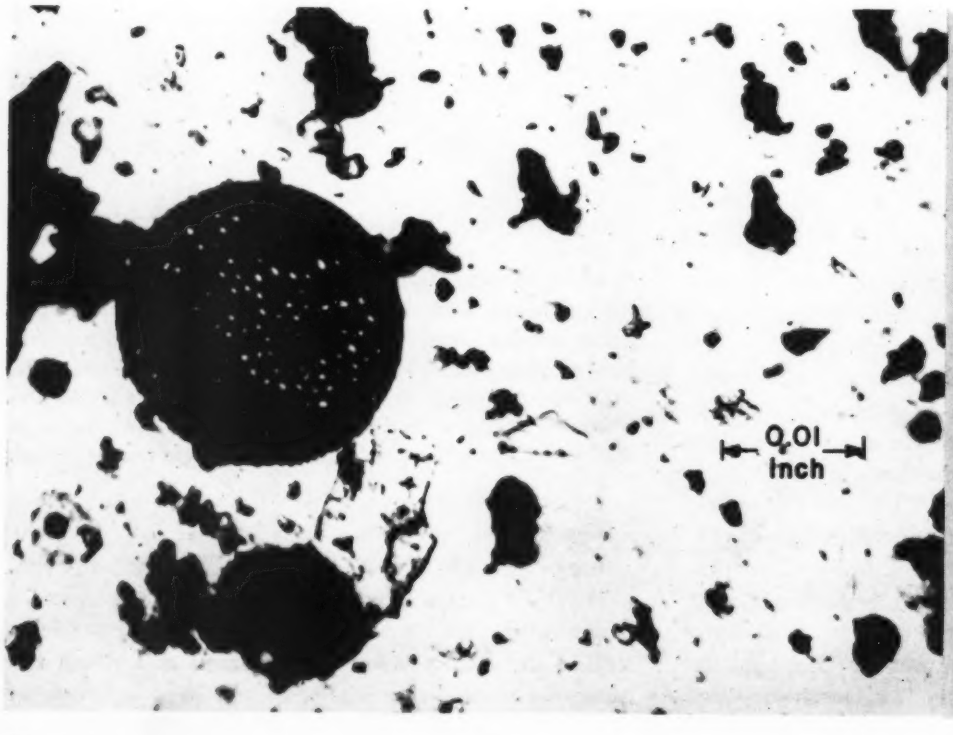
In addition to particle size and concentration, the composition of dust is highly important. Dusts are formed by reducing solid materials to small sizes by such processes as grinding, crushing, blasting, and drilling; therefore, their composition will be the same for all practical purposes as their parent materials. It follows that any material which has known toxic properties will produce a toxic dust.

The harmful effects caused by the inhalation of dusts can be thus summarized: specific lung diseases such as silicosis and asbestosis; toxic effects caused by breathing toxic dusts such as lead, cadmium, and radium; metal-fume fever which follows from inhalation of finely divided particles such as zinc oxide; and allergies which result from breathing dusts such as pollen and certain types of pulverized wood and flour.

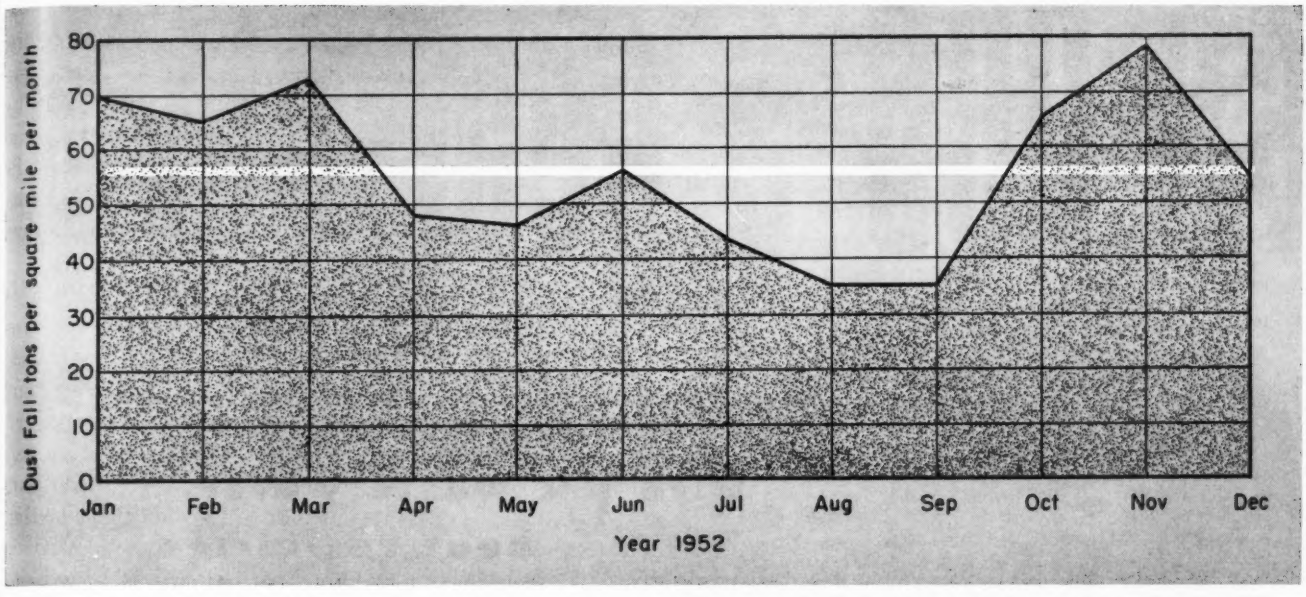
Fibrosis-producing dusts, such as those containing silica, make the lung much more susceptible to infection. Pneumoconiosis is a term used for any form of lung disease caused by the inhalation of dust. Anthracosilicosis is a pneumoconiosis commonly known as "miners asthma". It is basically caused by the silica in coal dust and is a disease which is the result of the combined effects of silicosis plus some infection of the lungs such as tuberculosis.

Dust diseases may be avoided by the proper control of dusty operations. Jobs should be performed in clean air as far as possible to minimize exposure. The human system can protect and cleanse itself to certain degree; therefore some moderate exposure can be tolerated.

Working hours should be reduced where dust




THIS IS A PHOTOMICROGRAPH OF A DUST SAMPLE TAKEN IN CHICAGO. THE LARGE CIRCULAR OBJECT AT THE LEFT IS A SPORE. SMALLER PARTICLES WHICH SHOW ARE FLY ASH, SOOT, AND QUARTZ.




DUST FALL IN CHICAGO FOLLOWS SEASONAL PATTERN; SUMMER MONTHS GENERALLY HAVE CLEANER AIR BECAUSE LESS FUEL IS BURNED FOR SPACE HEATING. WHITE LINE IS THE AVERAGE LEVEL OF DUST FALL FOR THE YEAR.

concentrations cannot be brought below established dangerous levels.

Safe methods may sometimes be substituted for unsafe ones. (Synthetic abrasive wheels containing no silica can replace natural sandstone wheels.)

Wet methods may replace dry methods for control over dusty atmospheres. Local exhaust hoods may be placed close to a source of pollution. The dust should be sent through a dust collector to prevent contaminating neighboring areas or return of the dust through open windows.

In some cases, application of general rather than local exhaust ventilation is desirable. There are instances where the source of polluting materials is constantly changing position and local exhaust becomes difficult and impracticable.

Routine recording of dusty concentrations is a valuable check on the existing hazards. Periodic counts of air samples are a great help in showing whether or not there is a need for further control.

Another method of protection is special equipment worn by workers. This step is frequently the last resort and is used only in an emergency or for jobs of short duration.

Several weather conditions have a decided influence on the amount of dust-fall. Wind velocity is perhaps the most important of these; strong winds stir up dust. Rainfall also is important since it wets down the dust and washes much of it away. Temperature is also important since more smoke-producing fuel is burned in cold weather. Dust-fall data show that about twice as much dust falls during January as during July.

Everyone is constantly breathing dust, especially those who live in large industrial cities where smoke and dust abatement is a major problem. A great deal of progress has been made in recent years in such cities as St. Louis and Pittsburgh by rigid enforcement of smoke and dust abatement ordinances.

Lung tissue of a city dweller appears black when examined upon autopsy whereas that of a farmer is pink in appearance. Although this cannot be taken as proof that urban living is less healthful, it does prove that city air is much dirtier than country air. ▲▲

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# Abuse of Resources Means Pollution

THE DISCHARGE of industrial wastes to natural waters and to the atmosphere is a legitimate use of natural resources, according to Roy W. Weston, sanitary engineer, Atlantic Refining Co. Speaking before the AIChE in St. Louis recently, he went on to say that it is only when this use of natural waters and air is abused that pollution abatement programs are necessary. Since the available resources for disposal are a constant, the discharge of wastes without abuse will become increasingly more difficult. Therefore, Weston feels that the need for pollution abatement measures will become more general and their requirements will become more strict. Estimates have been made that industry will have to spend several hundred million dollars per year for abatement purposes. ▲▲

# $9,000 a year saved

## by Royal Yarn Dyeing Corp. with p·k waste water heat reclaimer

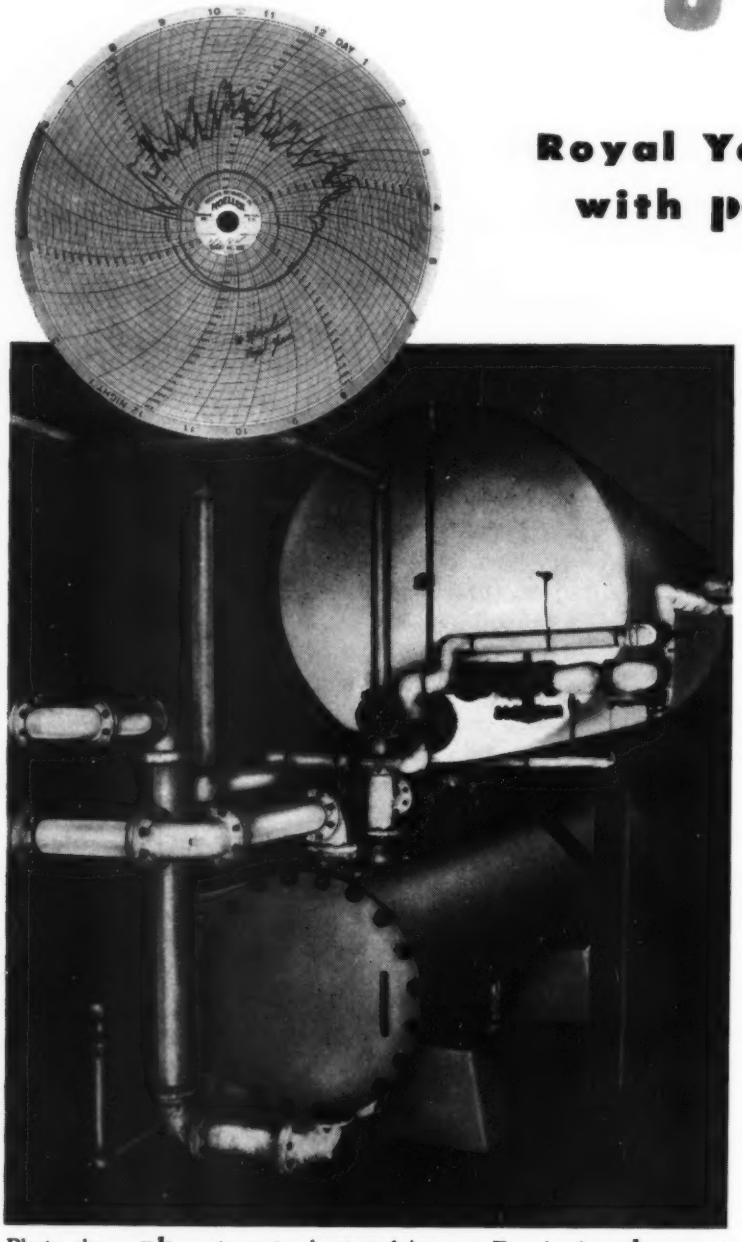

Photo shows p·k waste water heat reclaimer at Royal, plus p·k cement lined hot water storage heater. Chart authenticated by Mr. Kershaw, shows typical twelve hour day operation. Incoming city water is heated from 48° to 105°, without cost by the p·k waste water heat reclaimer.

Since they installed a p·k waste water heat reclaimer, Royal Yarn Dyeing Corp. of Brooklyn regularly save a minimum of 600 gallons of fuel oil each day, costing 6 cents a gallon.

Mr. Milton Kershaw, the Chief Engineer at the plant, says, "The p·k waste water heat reclaimer represents an additional 100 horsepower in working load." By taking hot waste water from dyeing vats and running it through the p·k heat reclaimer, city water temperature is increased from an average 48° to 105°. Heating incoming cold water in this way costs the company *nothing* – and has eliminated the need for additional boiler capacity.

If you are presently dumping hot process water down the drain, or not getting the maximum waste heat recovery from your present equipment, you can get the right facts and figures from p·k without obligation. Write now and ask for catalog #310.

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# the Range Finder

**DR. GERALD J. MATCHETT**

**Department of Business and Economics**

**and**

**Director, National Center of Dynamic Equipment Policy**

**Illinois Institute of Technology**

OPERATIONS RESEARCH is of interest to all consulting engineers who are concerned with decisions of management. Like a good many recent innovations, operations research is a war-time development; it got its start when teams of specialists were called in to solve a number of military problems. These specialists—mathematicians, engineers, physicists, statisticians, and other scientists—developed ways of deciding, for example, how to use available aircraft for best protection of shipping. It happened, as it usually does, that there were no ready-made rules for problems like these; therefore, new ways had to be devised for handling them. The ways, of course, brought into play techniques already available from other fields. Statistics and probability analysis, as would be expected, found important applications.

Some methods appropriate to the military also have application to industrial problems. What the operations research teams were doing was choosing among various alternatives the one most efficient for the purposes at hand. And this type of choosing process goes on regularly in the business world.

### A Definition

A precise definition of operations research is elusive. One definition calls it "a scientific method of providing executive departments with a quantitative basis for decisions regarding the operations under their control." Now to some extent, of course, this statement is descriptive of many professions. The cost analyst (when he supplies data on the cost of equipment) or the engineer (in determining output and operating requirements) give management necessary data for informed decisions.

Because operations research cuts across many fields, some people question whether it is really a new field at all. Thus industrial engineers often say that it is nothing but industrial engineering, mathematicians label it applied mathematics, and statisticians call it statistics. The same reaction occurs among management consultants, engineers, economists, psychologists, and political scientists. In short, a good many members of several professions feel that operations research is just another name for what they have been doing in the practice of their profession since the beginning of time.

The operations research worker does not deny that he has borrowed much from other fields—as a matter of fact, he stresses this feature of his work. However, he also emphasizes the distinctive qualities of operations research including its approach to problems. The emphasis, as the definition suggests, is on over-all operating decisions. The aim is to pull together all the factors impinging on the decision, whatever their nature. It seeks to make possible comparisons of business alternatives in which all relevant considerations are taken into thorough account.

### Emphasis on System

The operations research approach to any specific problem calls for studying the business organization as a whole. In other words, emphasis is taken off of the elements in a system and is placed on the system itself. Such an outlook developed from the realization that a single change in the operation of a business sets off a chain of further changes.

This chain effect is well illustrated by the experience of one research team that was called in to determine economical lot sizes for a company producing fourteen different models of a piece of equipment, each model containing about 6000 parts. Determination of the most efficient production runs was simple as compared to what followed. It was found necessary to redesign the accounting system to provide data for control purposes. Additional capital was required because of the need for higher

parts inventory levels. A financial analysis had to be made of the various sources of funds and the effects of each method of financing on the business.

Furthermore, shop routing procedures had to be developed; quantity and freight discounts on raw materials were investigated. Provisions had to be made for additional storage space. The market had to be studied, and a method for sales forecasting was developed. It was necessary to devise a method for converting from a period of variable demand to a period of fixed demand which the company would soon be entering. The analysis thus went far beyond the apparent limits of the problem originally posed. However, the benefits realized from the months of study and planning were beyond the most optimistic expectations of both management and the operations analysts.

Although sketchy, this case points out the comprehensive nature of operations research. It also points out the difficulty a consulting firm would have in estimating the time and cost required to conduct an operations analysis. For this reason, teams currently active in the field rarely make an attempt to forecast the magnitude of these elements. Instead, their approach is to request about two months to study the conditions in a client's plant. At the end of this time, they are sufficiently acquainted with the existing problems to give the required estimates. In approximately 90 percent of the cases studied by operations research teams, the major problems are not the ones which prompted management to request aid.

### Mathematical Model

In analyzing a problem, a mathematical model of the operation is customarily developed. The elements in this model correspond to the relevant factors, which may be engineering data, cost estimates, organizational structure of the business, and the like. In working with the model, use may be made of the theory of probability, linear programming techniques, and various statistical methods.

A unique characteristic of operations research is that it applies the team approach to any given problem. Individuals on a team have very divergent backgrounds including mathematics, market research, engineering, sales, and statistics. Each is a specialist in his particular field. The use of a team is indicated by the emphasis on study of the organization as a whole. Problems dealt with are often too complex to lie within the competence of any single specialist. Moreover, the nature of the problems which will ultimately be uncovered cannot be predicted; the team's approach allows for this.

An investigation of the types of problems which have been solved by operations analysts readily convinces even the most pessimistic observer that the accomplishments of operations research cannot be ignored. Its techniques have been used by equipment manufacturers in determining the sales potential in various districts. Oil companies have used it to arrive at the most efficient location of their gas stations. The distilling industry has relied upon it to solve problems of labor stabilization and inventory control.

### Divergent Users

Farm groups are turning to it for scheduling of crop planting and harvesting to establish a more constant labor force. Mining companies are finding its approach effective in determining optimum ore exploration limits. A tool manufacturing firm is employing operations research in its product development activities. Producers of consumer products are using its techniques to arrive at suitable quality control limits which will balance cost and customer satisfaction.

Many executives have limited familiarity with the techniques and terminology of operations research. The result is a reluctance to accept the findings or recommendations of the research team. For this reason operations consultants have been hesitant to contact potential clients for an operations research study. Where a business firm has had to be sold on the idea difficulties have been met in conducting the study and in convincing management of the validity of the results. On the other hand, when a firm has taken the initiative in obtaining the services of a research team, techniques and results have been readily accepted.

Operations research is not a cure-all for all industrial problems. There is room in the field for further research and development that may well expand its applicability and possibilities. There is the fact that operations research, using as it does the results of study in many fields, cannot be stronger than the sciences on which it rests. For example, human problems and values must often be taken into consideration in industrial policy; these factors are not always capable of accurate evaluation. Our understanding of individual psychology is far too sketchy to permit them to be; operations research cannot be expected to fill in all the gaps in our present store of knowledge about human behavior.

### Crystal Ball

Another fundamental limitation is that many types of business decisions are predictions—say as to market trends, competitor reactions, or technological developments. The collection and interpretation of significant data bearing on the future, as well as the use of appropriate techniques in handling probability, can be a help in appraising future possibilities. The methods used by operations research cannot eliminate all the guess work from business decisions. No one yet has invented a reliable crystal ball. ▲▲

# the Legal Aspect

**MELVIN NORD**

**Consultant in Legal and Technical Problems**
**Registered Professional Engineer**
**Chemical Engineer**
**Patent Attorney**

ONE OF THE MOST important branches of law, insofar as consulting engineers are concerned, is that of contracts. Basically, a contract is an agreement between two or more parties, each of whom is looking out for his own interests. In other words, it is an "arm's length" transaction. A gift, on the other hand, is of the opposite nature. It's not an "arm's length" transaction at all; it's more a "locked-in-a-fond-embrace" type of situation where one party is looking out for the interests of the other. A gift is a one-sided proposition, while a contract is a two- (or more) sided proposition.

### Consideration

Once this distinction is realized, the mystical concept of "consideration" becomes clear. Thus, when we say that a contract is an agreement based upon a consideration, we mean that each party gives up something in order to get a promise or an act from the other. "Giving up something" is another way of saying that each party must sacrifice some legal right. Thus, the two elements of a contract are the agreement and the consideration by each party.

There is an old-fashioned maxim to the effect that in order for there to be a contract, there must be a "meeting of the minds." As a judge once neatly put it, "This is a very interesting hypothesis, but it suffers from the defect of not being true." Luckily, there is no such requirement that the "minds of the parties must meet."

Who knows what goes on inside the minds of men? We can't let people escape from their obligations merely by saying, "Oh well, I said 'yes', but what I really meant was 'no'." Regardless of what was going on in the back of the parties' minds, they are governed by the outward appearance of their words and acts. As the lawyers put it, there must be objective (not subjective) manifestation of assent to a common proposition.

According to this "objective" rule, any conduct of a party from which the other may reasonably draw the inference of assent is effective as such. In borderline cases, this will be a question of fact for the jury to decide. A secret intention not to be bound—or not to be bound unless a certain contingency occurs—thus will be ineffective.

It is very important to appreciate the significance of the objective rule. For example, you would not be well advised to walk into an auction room after the bidding has started. For all you know, clearing your throat may be the signal for bidding; this may have been explained in plenty of detail just before you walked in. The fact that you didn't know it will be of no help if you accidentally turn out to be a buyer of a thousand pounds of tobacco. Unfortunately for you, the maxim is true that "ignorance of the law is no excuse."

### Case of Misunderstanding

On the other hand, an amazing case of a complete misunderstanding is the famous "Peerless" case. The parties agreed to buy and sell 125 bales of cotton at a specified price, to arrive at Liverpool on the ship "Peerless" from Bombay. When the ship "Peerless" arrived in Liverpool, the purchaser refused to accept the cotton. He had been thinking of the "Peerless" which was to sail from Bombay in October. The seller had been thinking of a different ship also called "Peerless", also sailing from Bombay to Liverpool, but leaving in December instead of October. Because of the fluctuating prices of cotton, it made a difference to the purchaser when the cotton was delivered. The court held that there was no contract, because there was no agreement. Objectively, it was perfectly reasonable for each party to be thinking of a different ship, so there was no objective manifestation of assent to a common proposition. Neither party had any claim on the other.

Now as to the doctrine of consideration in contracts,

the most important thing to know about consideration is not whether you give up something, or what you give up, but whether you give up something in return for what the other party gives. What the parties give as consideration must be an ingredient of a bargain. That is to say, whatever each party gives up must be as the "price" for whatever the opposite party gives up.

### Condition or Price

Thus, suppose a clothing store proprietor says to a tramp, "You look like you could use a new suit. Go around the corner into my store and I'll give you one for nothing." There is no contract here. It is true that the tramp gives up a legal right when he goes around the corner into the store (the right *not* to do that), but that was not the "price" of the proprietor's promise. It was only the *condition* upon which the proprietor promised to make a gift; it was not consideration inasmuch as the proprietor was to get nothing. The promise is not binding as a contract; a promise to make a gift is entirely ineffective.

A very important point to engineers is that a promise to do all or part of what one is already legally obligated to do can never be consideration for someone else's promise. The reason, of course, is that you give up nothing if you do only what you are legally obligated to do. Suppose, for example, that a building contractor thinks he is going to lose money and therefore decides to quit the job after it is only half done. In order to persuade him to complete the job, the owner promises to pay additional money. This is not a binding promise, because it is not based on any consideration. The fact that the contractor finished the job, which he otherwise wouldn't have done, doesn't help him a bit for he is only doing what he is legally obligated to do anyway.

### Power or Right

In such a case, the contractor would be likely to argue that he had a right to finish the job or to breach the contract and pay damages. The answer to this is that the contractor may have had the *power* to break his contract, but there is never a *right* to break a contract.

On the other hand, if the contractor had promised to do something extra as consideration for the extra money, the promise of the owner would have been binding.

### Adequate Consideration

This brings up the question of how small the consideration can be and still be consideration. The answer to this is extremely simple in principle: there is no rule requiring the consideration to be adequate. A contract may be a good bargain or a bad bargain—but so long as it is a bargain, it is a contract regardless of how inadequate the consideration may be. Thus, one dollar may be consideration for something which is quite valuable—such as the services of an engineer for a year. It may be—but then again it may not be.

The same thing can be consideration or not, depending on whether or not it is really the "bargain", "exchange", or "price." There is no magic formula of "$1 consideration" which will make a bare promise binding as a contract. It's not whether the parties *recite* a purported consideration that counts; it's whether this is really the "price." The courts are perfectly able to see through these smoke screens, so it is important to keep this in mind.

### Other Elements

It will be noted that there has been no mention of any other elements as being necessary for the formation of a contract—such as capacity of the parties to enter into a contract, "reality of consent", that the promise be possible to perform, or that there be nothing illegal in the transaction. To be sure, these all affect the enforceability of the contract in varying degrees, but they are not indispensable elements in the formation of a contract. Many writers to the contrary, there are only two indispensable elements in a contract—an (objective) agreement and consideration.

It will also be noted that no mention has been made of the need for having the contract in writing. This is for the very simple reason that there is no such general requirement, although certain kinds of contracts are, by statute, required to be written.

One more word of caution: just because you can show that legally there is no contract doesn't mean you can get away with murder, or with the other party's property. The law has other parts, too! ▲▲

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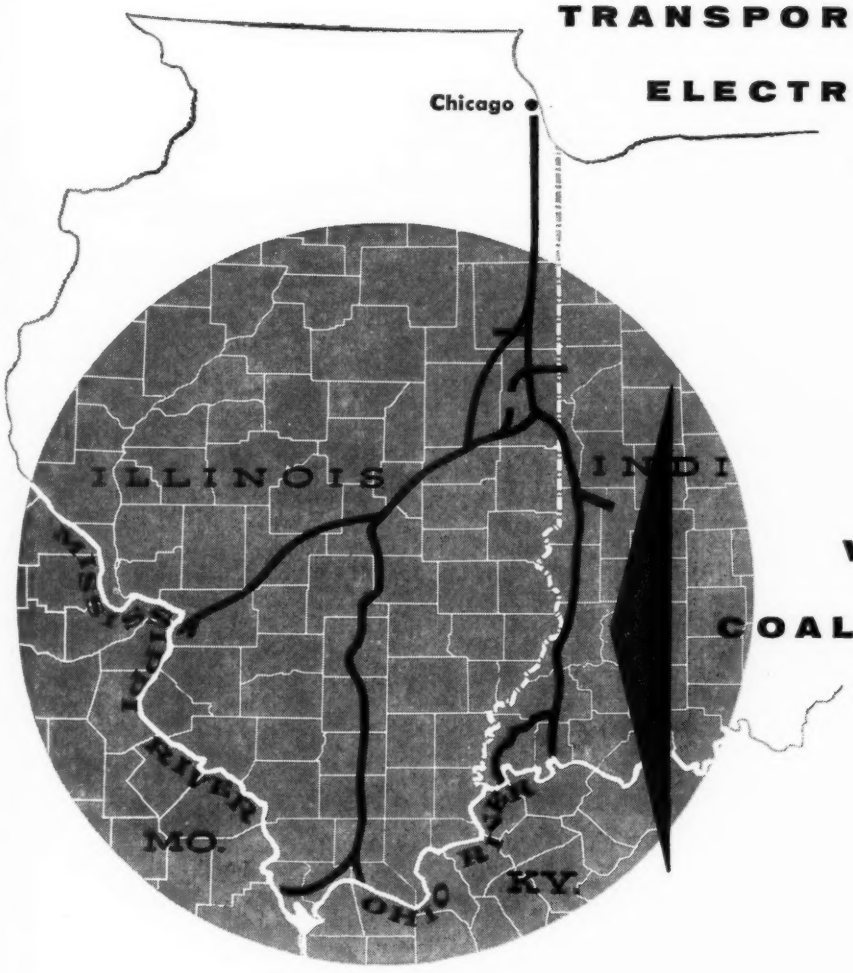
## CE quotes --

*Probably nothing has been a matter of such consuming public concern the world over during the past several months, as has the state of the American economy .... Since the start of 1942, the eyes of America and the rest of the world have become accustomed to watching spectacular feats on the part of this country's profit-motivated system of private capitalism. Some of these spectators now seem to regard any performance which is less than sensational as a sign that our system has lost its vigor and vitality.*

Clifford F. Hood
President, United States Steel

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**ask** about the millions of kw capacity available from private utilities . . . new stations under construction.

**ask** about the natural resources . . . the abundance of limestones, fluorspar, dolomite, sand, silica; also timber.

**ask** about the large, experienced labor force and the harmonious labor-management relations that exist.

**ask** about the proximity to major markets and the railroads, barge lines, river-rail transfers and highways.

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For factual information on the outstanding industrial opportunities in this Indiana-Illinois area, write in confidence to Chief Economist:

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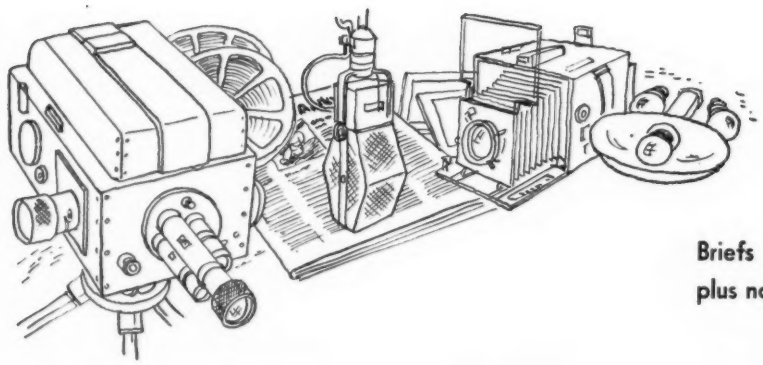
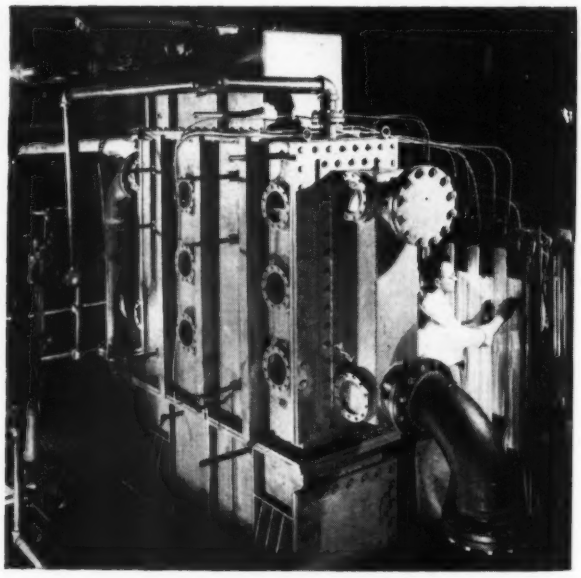


# NEWS

Briefs of current interest to the consulting profession plus notes on new equipment in the field of engineering



## Test Condenser Used to Study Design Problems

An experimental surface type steam condenser has been built by Allis-Chalmers Manufacturing Co. to accumulate heat transfer data that are expected to lead to improved commercial design.

The model has been designed to permit it to be adapted to various tube and baffle arrangements as well as different tube sizes and materials. Through the use of a removable type tube bundle, tests can be run that will allow the investigation of the heat transfer characteristics of a series of varied tube configurations.

Initial tests will use 280 $\frac{5}{8}$-in. dia tubes to give a total effective surface area of 276 sq ft. The surface available in this condenser will then vary as different size tubes and configurations are used. ▲▲

## Generating Station Boasts Modern Design

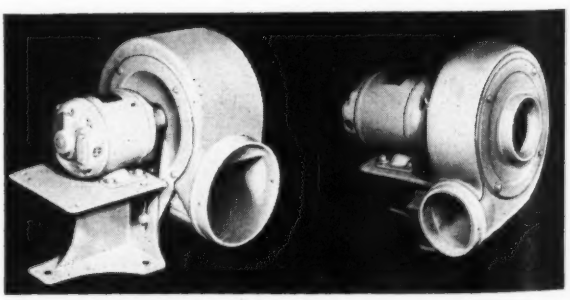
Objectives in the design of the new Kearny Generating Station in New Jersey were to achieve a plant which would be simply arranged with central control to reduce operating effort; a steam cycle to take advantage of high steam temperature and pressure; and a relatively small building resulting in low first-cost and maintenance.

The new station has for its principal equipment two General Electric Co. turbine generators, and two water-tube, controlled circulation, Combustion Engineering boilers arranged in the unit system.

The entire plant is operated from a control room located in the center of the square formed by four major items of equipment. The new units are operated as a separate station with practically no ties, electrically or mechanically, with the old station next door. The boilers are close to the turbines, hence the steam leads are short. The coal pulverizers are placed alongside and between the boilers and are enclosed in a separate ventilated room. The feeders of all pulverizers are accessible from one platform.

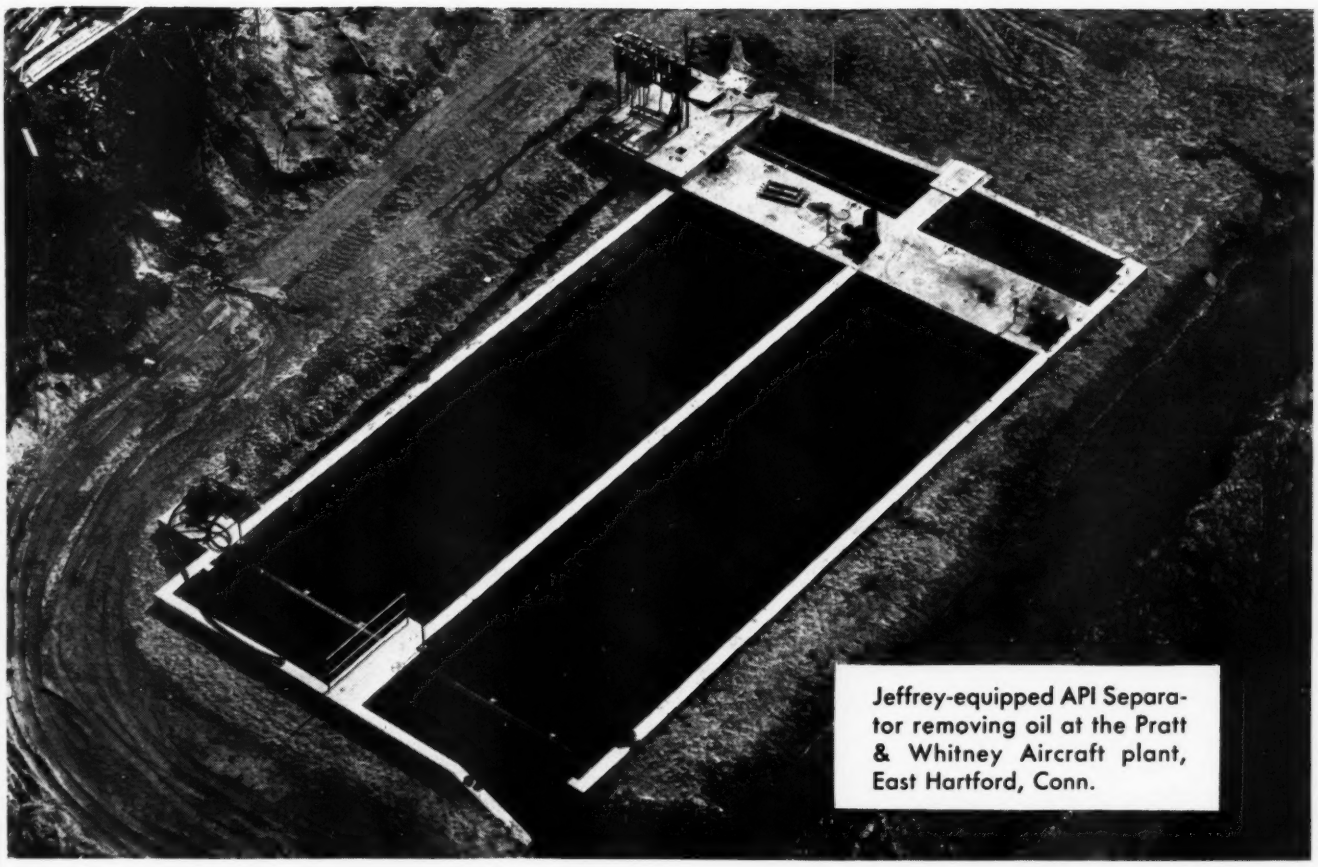
The new Kearny Generating Station is designed for two-level operation, with the two levels 15 ft apart. All parts of the boilers are out-of-doors except the burner areas and the bottoms of the furnaces. The top drum and the three steam headers of each boiler are enclosed in the boiler casing.

With completion of this station and its two 145,000 kw steam turbine-generator units, the Public Service Electric and Gas Co. system capacity has been increased to 1,910,300 kw. ▲▲



## Fans Suitable For Corrosive Atmosphere

For quiet longevity and minimum maintenance, both of these fans have as standard equipment self aligning, grease lubricated ball bearing pillow blocks. Bronze sleeve type bearings, impregnated



Jeffrey-equipped API Separator removing oil at the Pratt & Whitney Aircraft plant, East Hartford, Conn.

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Are state or federal anti-pollution laws giving you headaches? Then call on Jeffrey Sanitary Engineers for practical relief. A Jeffrey-designed installation will neutralize your industrial wastes efficiently. Here's how:

**CHEMICAL DOSING:** Jeffrey WAYTROLS, Bin Check Valves and Vibrating Feeders assure continuous, automatic dosage.

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**SETTLING:** Jeffrey automatic, continuous Sludge Collectors scrape deposit to sump at end where it is pumped out and de-watered or sent to lagoons.

Hundreds of industrial wastes treatment plants throughout the nation are now Jeffrey-equipped. Scores of industries have found Jeffrey's wide engineering experience and broad line of proved equipment the best answer to pollution problems.

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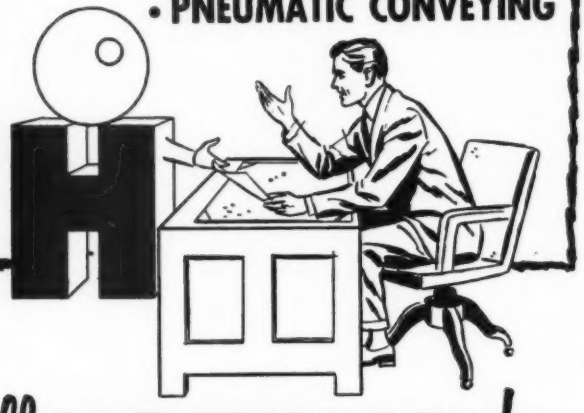

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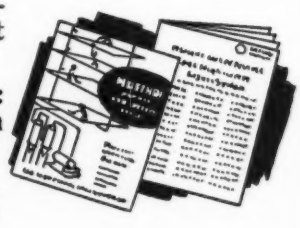
**Write for free treatise: "Design Factors in Vacuum Cleaning."**



*Hoffman also builds centrifugal blowers and exhausters for every industrial use.*

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## Fans For Corrosive Service

—*Starts on page 56*

with graphite and having a large wool-packed oil reservoir, can also be furnished.

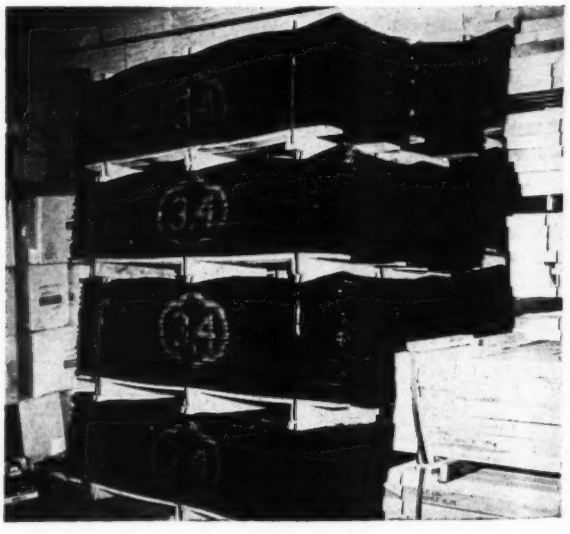
The "LV" large volume (left) is available in four sizes with a forward curved wheel of all welded construction which is both statically and dynamically balanced. The "PB" pressure blower type utilizes a radial bladed wheel of aluminum alloy.

Both fans are supplied with motors of nationally known make and generally, single phase fractional sizes are resilient mounted. Integral polyphase motors are rigid ball bearing types.

The "LV" is well suited for applications where moisture or corrosive gas is present; the "PB" is primarily for use in industrial process work to supply or exhaust air, and is specially coated or constructed of special metals to withstand corrosive or explosive atmospheres.

Type "LV" furnishes volumes up to 2124 cfm and pressures to 1½ psi static pressure; Type "PB" furnishes volumes up to 335 cfm and pressures to 4 psi static pressure.

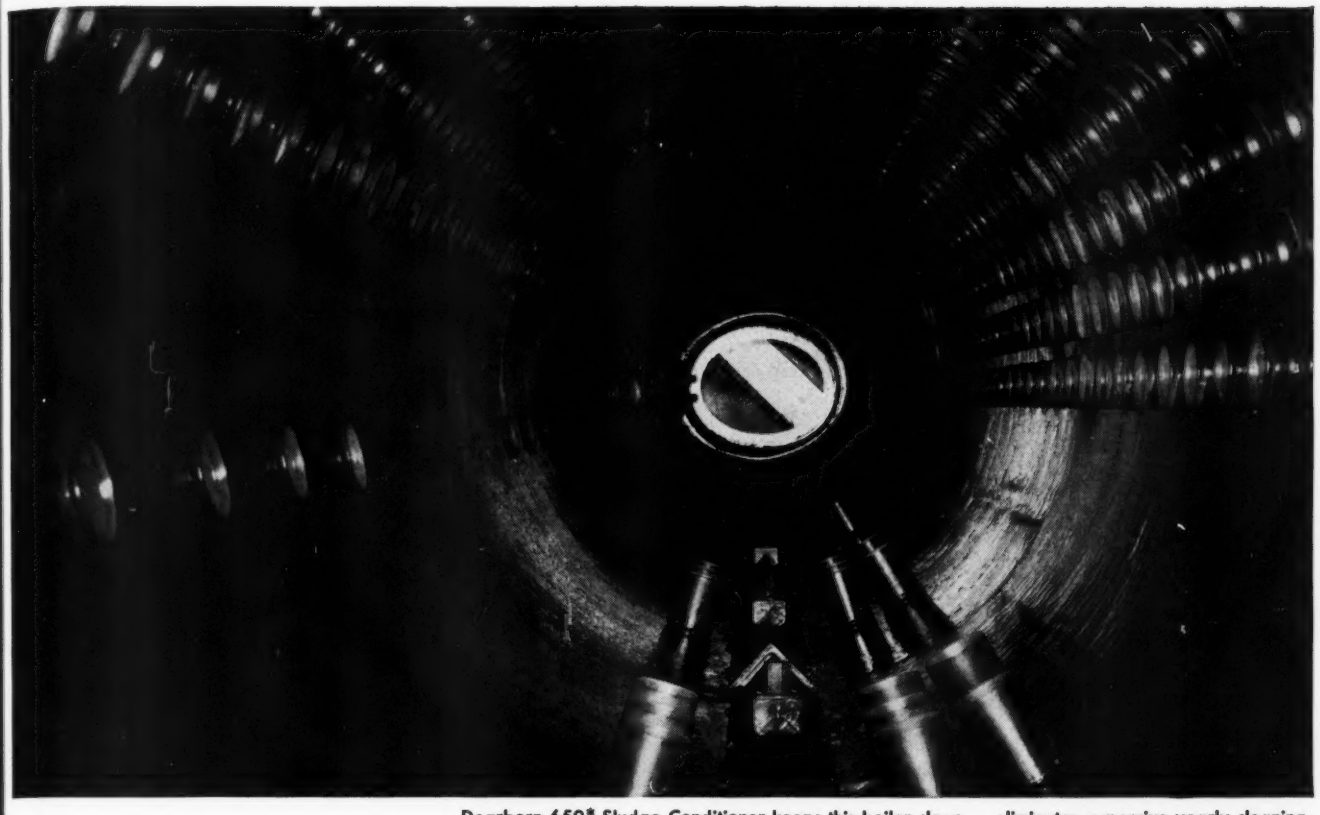
Manufacturer is Chicago Blower Corp., 9867 Pacific Ave., Franklin Park, Ill. ▲▲



## Shipping Simplified With Use of Metal Lath Package

Costly storage, shipping, and handling problems in the use of metal lath are said to be surmounted by a new engineered package developed by Wheeling Corrugating Co.

Diamond mesh lath is now available in 50 bundle (500 sheets) compact units, securely packed and banded at the factory, designed for swift handling with fork truck or crane. In the past, ten-sheet bundles arrived at dealer warehouses and had to be handled individually, a process which required approximately a full day's labor of four workers. Lath in this form would not stack higher than 100



Dearborn 659* Sludge Conditioner keeps this boiler clean . . . eliminates expensive yearly cleaning.

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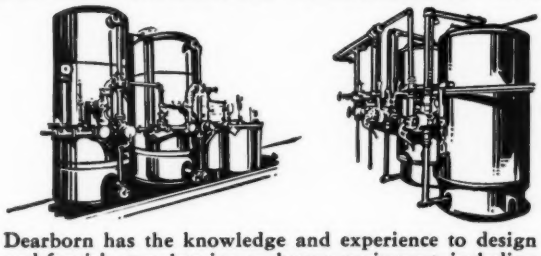
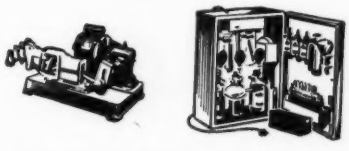
## DEARBORN EXTERNAL TREATMENT SYSTEMS



Dearborn has the knowledge and experience to design and furnish complete ion-exchange equipment, including mono-bed and 2-bed demineralizers, sodium-hydrogen split stream softeners, sodium exchange softeners either alone or in conjunction with hot lime softeners.

## INTERNAL TREATMENT EQUIPMENT



Get plus results with Dearborn engineered water treatment feeding, proportioning and test equipment. Let your Dearborn engineer analyze existing equipment, plan a plant layout, and recommend the system you need.

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Dearborn has specialized in the conditioning of water and the control of corrosion since 1887. This broad experience in water treatment and rust prevention—plus Dearborn's extensive research and laboratory facilities are at your service. It will pay you to consult with your Dearborn engineer.

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**DEARBORN CHEMICAL COMPANY · Merchandise Mart Plaza, Chicago 54, Illinois**

FAST! EASY! convenient...

MANAGEMENT: For Copying Letters, Reports, Contracts, Instructions, Statistics, Etc.

SALES: For Copying Orders, Letters, Inquiries, Presentations, Price Sheets, Etc.

PHOTOCOPYING

MANUFACTURING: For Copying Schedules, Work Sheets, Control Sheets, Master Records, Inventory Records, Etc.

SHIPPING: For Copying Receipts, Claims, Freight Bills, Packing Slips, Bills of Lading, Etc.

Use It To Copy

ANYTHING right in your own office!

APECO Systematic Auto-Stat

EXPOSE!

PROCESS!

COPIES PEEL APART!

EVERY DEPARTMENT can use the Apeco Systematic Auto-Stat. This new all electric photocopying machine prints, processes and dries automatically. It's fast—dry copies in less than 45 seconds! It's convenient—fits on the corner of any desk . . . it's ready for instant use! It's easy—anyone can operate it! Saves up to 80% on copying jobs. Eliminates retyping, hand copying, checking or costly outside copying service. Makes legally accepted black and white or colored copies from any original up to 11" x 17"—printed on one or two sides. So low cost—a complete Apeco Systematic Auto-Stat installation is priced well within the budget of even the smallest firm.

Lifetime Service Guarantee

NEW COMPLETE PHOTOCOPY INFORMATION KIT—IT'S FREE

American Photocopy Equipment Co.
1962 W. Peterson, Chicago 26, Illinois

RUSH ME NEW PHOTOCOPY INFORMATION KIT containing booklet on the Apeco Auto-Stat plus separate folders on copying tax returns, color copying and copying on preprinted forms.

Name_____

Firm_____

Address_____

City_____ State_____

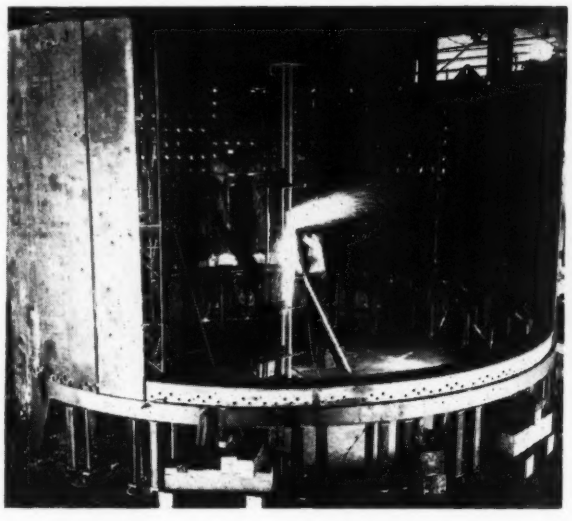
In Canada: APECO OF CANADA, LTD., 134 PARK LAWN ROAD, TORONTO, ONT.

## Metal Lath Packaged

—*Starts on page 58*

bundles to a pile because of bowing. At best the stacks were shaky, resulting in a safety hazard.

When Wheeling's new package arrives at the warehouse, one man with a fork truck can unload a car in 45 min. In the warehouse, the receiver can stack packages as high as ceilings permit without fear of instability or warping, increasing storage space 50 to 100 percent. ▲▲



## Tunnel Shield Used As Cutting Edge

The tunnel shield being built for construction of the third tube of Lincoln Tunnel will be the actual cutting edge used to bore the new tube through the bed of the Hudson River.

As sections of mud and rock are removed from in front of a shield, it is thrust through the muck under high hydraulic pressure, and the cast iron and cast steel rings which form the lining of the tube are erected in the tail of the shield.

Fabricated under a contract awarded to American Locomotive Co. by The Port of New York Authority, the shield will measure 31 ft 8 in. in dia by 18 ft 4 in. in length. Steel plates, varying from ½ to 3 in. in thickness, will be bolted to steel castings: these castings constitute the cutting edge of the shield. The first tunnel shield to be built using an all-welded steel shell and internal structure, it is thought to be stronger than conventional shields.

Twenty-eight hydraulic jacks of 200-ton capacity each will be attached to the back of the shield. They will propel the shield forward, 32 in. at a time, thus permitting erection of the cast iron or cast steel ring segments which line the tunnel. The entire tube will be driven from the New Jersey side of the river.

Contractors are Mason & Hanger Co., Inc., Arthur A. Johnson Corp., and MacLean-Grove & Co., Inc. ▲▲

# IT WAS A LONG MEETING
## –and all we talked about was ash

Yes, gentlemen, we know what you mean. Ash from burning coal is on the agenda of many meetings today —meetings of industrial and utility power-plant operators, air-pollution control boards, and civic-minded groups.

And when you're running a big power plant whose boilers consume many tons of coal every hour, ash disposal becomes a serious problem for discussion. You must talk about the high cost of equipment to trap fly-ash before it leaves the stack . . . the expense of paying for carting away tons and tons of this waste . . . and, of course, how to get the most out of the coals you buy, even if their ash content is high.

These and related problems have plagued industrial and utility power-plant men for years, the more so because they have a keen sense of responsibility for keeping their cities clean, and they are determined to keep operating costs down not only in their own interest but also that of the public.

We would like to make a suggestion. Put B&W's Cyclone Furnace on the agenda for your next meeting . . . and the day you put the Cyclone on your firing aisle you'll start enjoying advantages more and more power-plant men are discussing.

This more efficient method of burning coal converts most of the ash to molten slag, which drains continuously into a water pit for disposal.

If need be, the small amount of fly-ash remaining in the stack gases can be trapped by simple, inexpensive ash collectors and then returned to the Cyclone Furnace to be melted into slag. Result: Elimination of air pollution and of the costly mess of fly-ash disposal.

The Cyclone has many other advantages of interest—increased combustion efficiency, greater fuel flexibility, increased safety, and easier operation.

All this is accomplished—and is being proved in daily service—with *less equipment, less building volume, less manual labor,* and *less maintenance* than is possible when pulverized coal is used. For the Cyclone Furnace is a vast simplification of the entire process of coal preparation, combustion, ash segregation, and ash handling, which brings important savings right down the line.

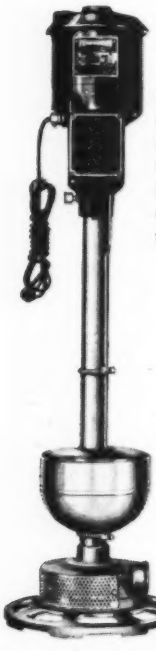
Selected to fire some of the world's largest and most efficient boilers, Cyclone Furnaces are in operation—under a variety of operating conditions—in different parts of the country. Based on this intensive, long-range experience, we will be pleased to discuss the advantages wnich the Cyclone Furnace offers.

BABCOCK & WILCOX
BOILER DIVISION

N-166

*There's Certain satisfaction in* **PRODUCTS BY**

# PENBERTHY

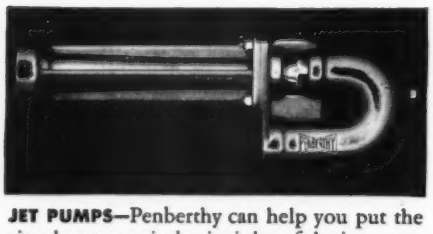


**Automatic Electric SUMP PUMPS**

Corrosion resistant Penberthy sump pumps, copper and bronze throughout, are available in 7 sizes, 3 models. Now, the *new submersible* sump pump offers additional superior features worth investigating.

**LIQUID LEVEL GAGES**

Penberthy makes a complete line of gages and valves. 70 years of engineering experience is on hand to accomodate your particular requirements. You are assured complete cooperation and reliable product service for any pressure...in any length.



**JET PUMPS**—Penberthy can help you put the simple, economical principles of the jet pump to work wherever it's necessary to transfer or mix any liquid which will flow through a pipe. We make a complete line.

**• EJECTORS • SYPHONS • EXHAUSTERS**
**• EDUCTORS • INJECTORS**
**• CYCLING JET PUMPS**

...are among the other products by Penberthy. Write for literature detailing specifications and advantages.

**PENBERTHY INJECTOR COMPANY**
*Division of the Buffalo-Eclipse Corporation*
**1242 Holden Ave., Detroit 2, Michigan**
Manufacturers of Quality Products Since 1886

# MEN IN ENGINEERING

★ In line with recent organizational changes, Arthur D. Little, Inc. announces appointment of two new vice presidents and two new directors to the board. New vice presidents are Dr. Lawrence W. Bass and D. Reid Weedon. Stuart Heddon and William Webster are the directors.

★ Benjamin S. Troop joins the laboratory staff of the Timber Engineering Co., affiliate of National Lumber Manufacturers Assoc. Warren E. Racine joins the engineering staff.

★ Frank A. Cowan, assistant director of operation, Long Lines Depart., American Telephone & Telegraph Co. is awarded the 1953 Lamme Gold Medal by the American Institute of Electrical Engineers.

★ Combustion Engineering, Inc. announces appointment of Dr. R. C. Ulmer as head of the research department, succeeding B. J. Cross. Cross has been appointed research consultant.

★ Robert A. Stauffer and Kenneth G. Donald are elected to the Board of directors of National Research Corp. Dr. James H. Gardner becomes assistant director of the Petrochemicals Dept., and Dr. Charles I. Tewksbury is appointed to the position of project manager in the Petrochemicals Dept.

★ H. K. Ferguson Co. announces appointment of Norvon Clark as Eastern district contract manager.

★ Alfred C. Emmerling, Paul S. Calkins, and Peter Mortenson, Jr. have merged their professional practices to form Emmerling, Calkins, & Mortenson, Inc., Architects and Engineers. Offices are at 112 Madison Ave., Detroit 26, Mich.

★ President of the American Concrete Institute for 1954 is Charles H. Scholer, Kansas State College. Frank Kerekes, Iowa State College, is elected to a two-year term as vice president. Directors for three-year terms are Phil M. Ferguson, University of Texas; Joseph F. Jelley, Dept. of Defense; H. C. Ross, Hydro-Electric Power Commission of Ontario; and George W. Washa, University of Wisconsin. Charles S. Whitney, of Ammann and Whitney, is serving the second year of a two-year term as vice president.

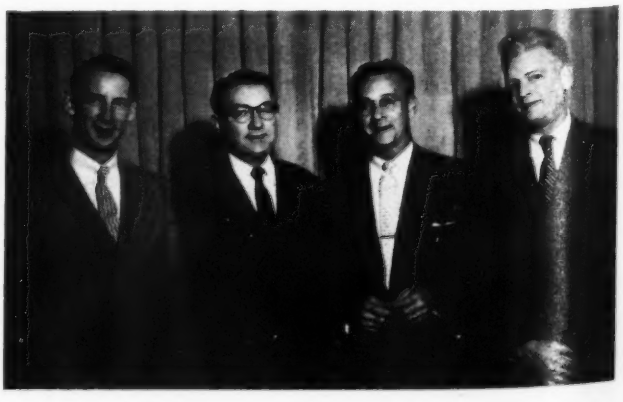
★ Harvey K. Breckenridge joins Ebasco Services, Inc. as general manager of its Greek electrification program. He was formerly a vice president and director of West Penn Power Co.

★ Director of the city of Philadelphia's Division of Air Pollution Control will be S. C. Rothmann. He succeeds John R. Hodges who resigned.

★ Foster D. Snell, Inc., Consulting Chemists and Engineers announce

COOLING TOWER INSTITUTE

New officers are, l to r: vp, P. R. Hoffmann of Lilie-Hoffmann Cooling Towers, Inc.; pres, N. B. LauBach of Hudson Engineering Corp.; sec'y, C. E. Pickup of Fluor Corp; and treas, R. R. Pabodie of United Cooling Tower Co. President for 1953 was Leon T. Mart of the Marley Co.



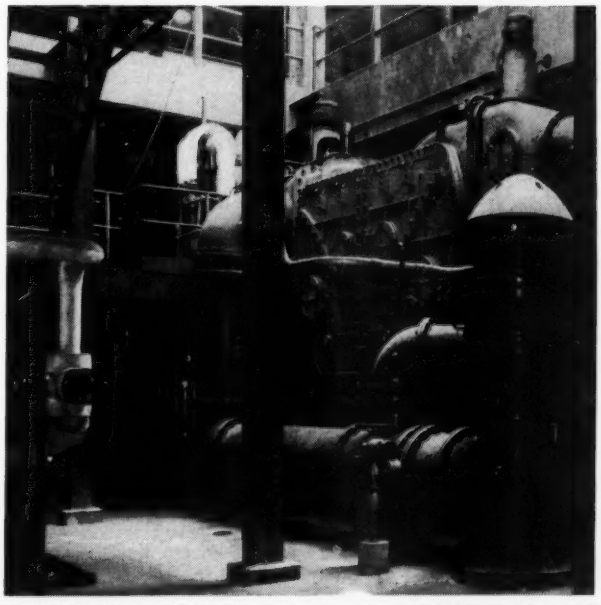
# NOTES

for the engineer's note book

## . . . ON WHEELER-ECONOMY POWER PLANT EQUIPMENT

### NO SHUTDOWN, NO LOAD REDUCTION, NO HAND CLEANING . . . WITH C. H. WHEELER *REVERSE FLOW* CONDENSERS

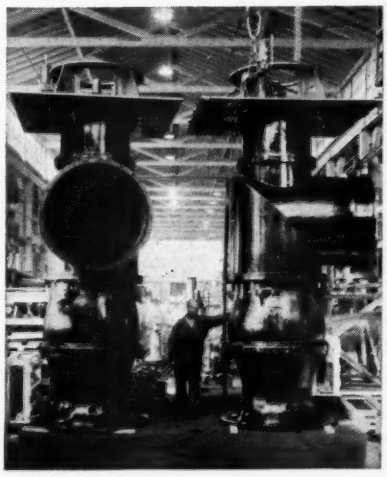
The savings in dollars and downtime effected by C. H. Wheeler's Reverse Flow design for steam condensers are a matter of record in public utilities and private power plants throughout the country. Chances are, you can inspect a nearby installation and learn first hand how efficiently debris of vegetable, animal and mineral matter is dislodged from the tube sheet and flushed away by reversing the flow of the cooling water through the Condenser. Cleaning work that formerly took hours is accomplished in minutes with no interruption in load. C. H. Wheeler custom-engineers your steam condensing hook-up to pay off in long range sustained efficiency. (Bulletins mailed on request.)



### WHEELER - ECONOMY CIRCULATORS

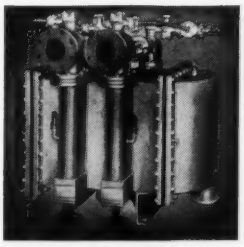
***Lasting Dependability***
***Minimum Maintenance***

Wheeler-Economy Circulators include: mix-flow vertical wet pit type with both standard and pull-out design; vertical mix-flow volute type for dry pit installations; and horizontal single stage centrifugal constructions to 100,000 GPM capacities. Wheeler-Economy pumps for general service include: single stage high head double suction; multi-stage with horizontal or vertical split case; pumps for sump, process and fire protection services. Wheeler-Economy also invites your special problems requiring custom design. (Bulletins mailed on request.)



### TUBEJET AIR EJECTORS

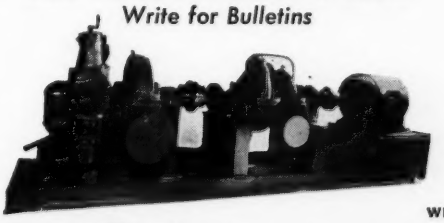
***Steel Shell***
***More Reliable***



C. H. Wheeler Steel Shell Tubejet Air Ejectors provide worthwhile savings in space and weight. They are available with either single or multiple element, two-stage type with combined surface inter-after condenser. Write for Bulletin.

### WHEELER-ECONOMY CONDENSATE PUMPS for Condenser Service with Turbine and Motor Drive

*Write for Bulletins*



WE-400

# C. H. WHEELER *of Philadelphia*

C. H. WHEELER MANUFACTURING CO., 19th & LEHIGH, PHILADELPHIA 32, PENNA.

Steam Condensers • Centrifugal, Axial and Mixed Flow Pumps • Steam Jet Ejectors • Vacuum Refrigeration
High Vacuum Process Equipment • Micro-Particle Reduction Mills • Marine Condensers and Ejectors • Deck Machinery.

# You can have Double Safety through Double Supervision of your boiler water levels

## Thousands of boilers like yours protected by this Safety Team

Depending on one source of water level checking is short-sighted these days. Make *doubly sure* with the Reliance Safety Team. The Alarm Water Column with sensitive float-operated mechanism faithfully warns with a whistle blast if level reaches unsafe low or high positions. But operators rarely let that happen when they have constant access to the accurate EYE-HYE Remote Gage reading, located conveniently at eye-level on panel or wall.

EYE-HYE's green indicating fluid is now more evenly illuminated by a fluorescent lamp. And EYE-HYE can be equipped to control lamps or horns in still other plant locations. Make your boiler extra safe like the many in steam plants everywhere enjoying Safety Team water level supervision. Write the factory or your nearest Reliance representative.

**The Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland 3, O.**

*The name that introduced safety water columns....in 1884*

**Reliance®**

**BOILER SAFETY DEVICES**


## MEN

—*Starts on page 62*

the following staff promotions: Shepherd Stigman to assistant to the director of personnel and public relations, and Fortuno De Angelis to assistant to the director of market research.

★ Edward F. McCrossin, of McCrossin & Co., is elected a director of Yuba Consolidated Gold Fields. He fills a vacancy caused by the death of James A. Bailey.

★ J. Donald Kroeker and Associates have moved into their new air conditioned office building at 4505 SW Corbett Ave., Portland, Oregon.

★ New address for Harry W. Smith, Inc. is 41 East 42nd St., New York.

★ Monty F. Woodruff joins the staff of Drake & Townsend, Inc. of New York. He will be available to utilities and industries interested in propane plants.

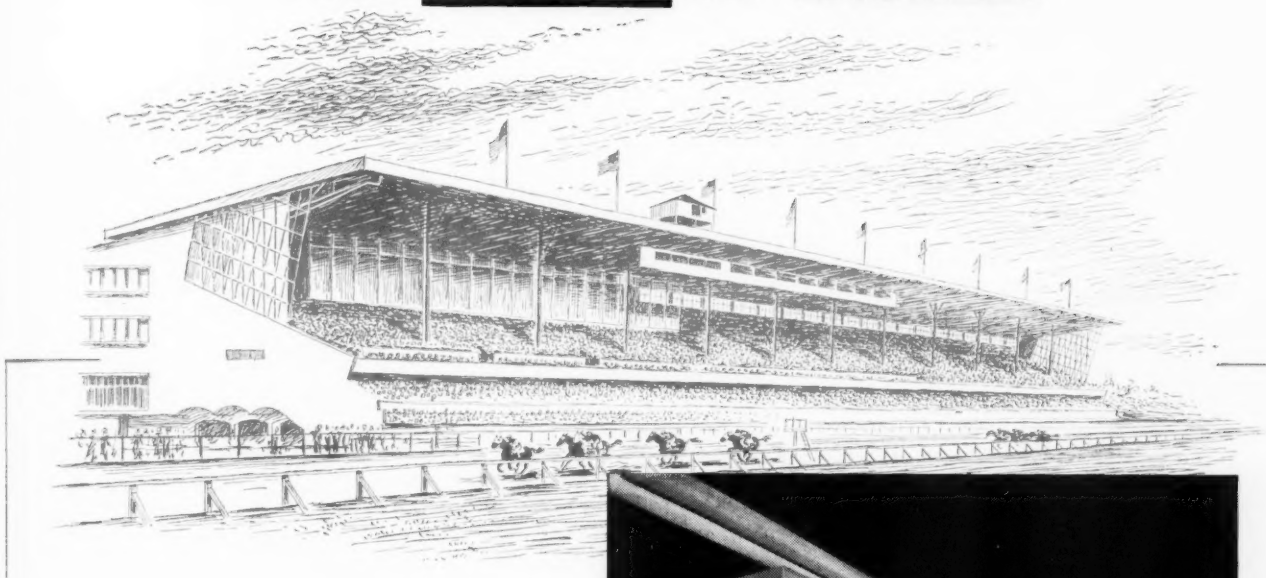
★ Harold E. Brailey, of New York, and William F. Ryan and Ralph D. Waterman, both of Boston are elected directors of Stone & Webster Engineering Corp. All three men are vice presidents of the company. Alfred L. Hartridge and Stuart F. Kosters are elected vice presidents, and Thomas W. Barry is appointed an assistant treasurer.

★ The first of two units of the Waneta hydroelectric power station is now in operation at Waneta, British Columbia. The new plant, designed and constructed by Stone & Webster Canada Ltd. in collaboration with Stone & Webster Engineering Corp., Boston, is owned by The Consolidated Mining and Smelting Co. of Canada, Ltd.

There is a number representing my desired wealth at the age 90; if I take the last digit of that number and transpose it to the front of the number, the result is nine times the original number. What is my desired wealth ie., the original number? (Mental deduction and simple arithmetic are all that's needed.)

*Answer on page 11*

# FEDERAL NOARK® POWER CENTER... THE WINNER AT LAUREL!

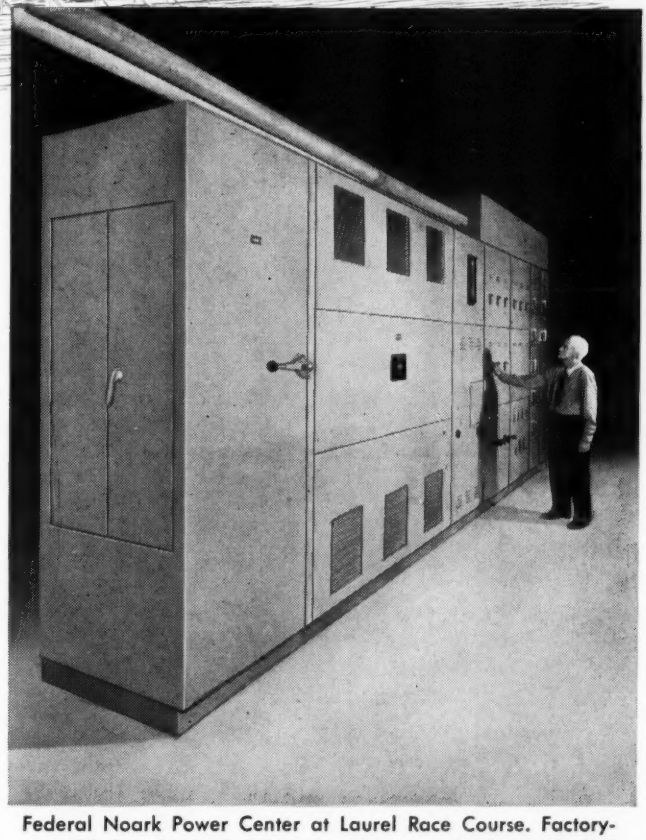


IT TAKES ELECTRICITY to operate a race track. Without electricity you'd have trouble buying an admission ticket or placing a bet . . . and how could the horses get through the gates or give you a photofinish? Well, Laurel, in Maryland, is today's most modern track, and its electrical system is controlled by Federal Noark main service equipment, lighting and power panels, motor controls, control centers and a unit substation.

Federal Noark equipment is today's best answer in buildings of every type and wherever else there's an electric light and power control problem. Most of this equipment is factory-assembled from standard units to meet individual specifications. All of it brings minimum installation costs . . . and is designed for maximum efficiency, easiest maintenance and remarkable flexibility for later changes or expansion.

Next time you have an electrical distribution problem, pass it on to Federal Noark for the most practical and economical solution.

**FEDERAL ELECTRIC PRODUCTS COMPANY**
50 PARIS STREET, NEWARK 5, N. J.



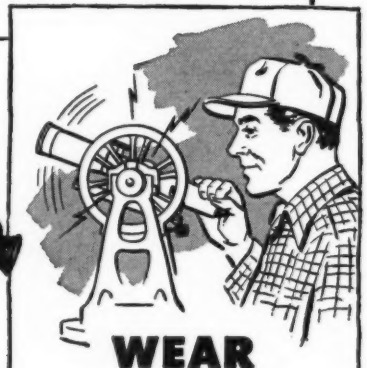
Federal Noark Power Center at Laurel Race Course. Factory-assembled and tested. Circuit breakers completely interlocked in all positions . . . high voltage switches coordinated with power fuses. Complete sectionalizing between high and low voltage and individual breakers makes maintenance safe and easy. On the complete Laurel electrical system, Architect was Arthur Froehlich, Beverly Hills, California; Contractor, Harry S. Mickey, Baltimore, Maryland.

**Federal Noark products:** Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct — **Pacific Electric Manufacturing Corporation products:** High voltage circuit breakers and power switches ★ Sales offices in principal cities.

**FEDERAL NOARK®**

# Here's the Answer to the 3 Big Headaches in Transits...

DIRT



WEAR

*Model No. 50*

REPAIR

Dirt . . . Wear . . . Repair—the three big troubles that impair every transit and level unless it's a Brunson. Dirt that gets between movable parts and causes binding. Wear from friction between movable parts that starts reducing accuracy from the day you first use the instrument. Costly maintenance to overcome the effects of dirt and wear.

Brunson has the answer to all three factors: dustproof, ball bearing construction. Dust is sealed out, the lubricant sealed in, and wear is practically eliminated by the smooth ball bearing action. That's why only Brunson instruments maintain their accuracy for years without costly routine maintenance.

Brunson instruments are the new standard of excellence—yet they cost no more. Write today—you'll be glad you did.

BRUNSON

*The New Standard of Excellence*

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**BRUNING**

*Everything for the Engineer and Draftsman*

CHARLES BRUNING COMPANY, INC. • 4700 MONTROSE AVENUE • CHICAGO 41, ILLINOIS


## MEN

—*Starts on page 62*

★ Kings County Chapter of the New York State Society of Professional Engineers awarded Certificates of Honor to Dr. James F. Fairman, vice president of Consolidated Edison Co. of New York and to Dr. Erich Hausmann, Dean Emeritus of Brooklyn Polytechnic Institute. The awards are in recognition of Dr. Fairman's appointment to the New York State Board of Examiners of Professional Engineers and Land Surveyors, and Dr. Hausmann's outstanding service as past member of the Board.

★ Dr. Edgar L. Piret, professor of chemical engineering at the University of Minnesota and engineering consultant for Minnesota Mining & Manufacturing Co., has sailed from New York City for a European lecture tour sponsored by the Royal Institute of Swedish Engineers.

PIRET LIGHTFOOT

★ The Lummus Co. announces the association of C. E. Lightfoot with the firm.

★ E. A. Hengst, Westfield, N. J., is named treasurer of the American Gas and Electric Co. He also has been named treasurer of all AGE subsidiary companies, including the AGE Service Corp.

★ Appointment of Colonel Leslie S. Fletcher to the newly created position of research fund director, American Society of Tool Engineers, is announced.

★ The second scholarship in the field of material handling has been established at Wayne University in Detroit in memory of the late W. J. Dernberger of the Ford Motor Co. The scholarship is jointly sponsored by The Material Handling Institute and the American Material Handling Society. The selection of the recipient of the scholarship will be made by the College-Industry Committee on Material Handling Education.

★ S. Schwartz & Associates Consulting Engineers, announce the opening of a branch office in Starkville, Mississippi, in order to more effectively serve clients in the mid-south and southwest.

## Figurenometry Answer

Both numbers must have the same number of digits; the terms of the problem dictate that the first digit must be "1" and the last digit must be "9". The second digit of the original number must be zero since any larger number would result in a carryover in multiplication, thereby increasing the number of digits in the resultant second number; this, of course, is not permissible under the terms of the problem.

We have established then that the first two digits in the original number are "10"; the last digit in the original number and the first digit in the second number must be "9". Now, when multiplying the original number by "9" as proposed, the right-hand end of the resulting product begins to form by multiplying the final "9" in the original number by the postulated "9" multiplier. The result is "81"; this dictates that the final digit in the second number must be a "1" with "8" carried over. The final "1" in the second number is the next-to-the-last digit in the original number; it preceeds the final "9".

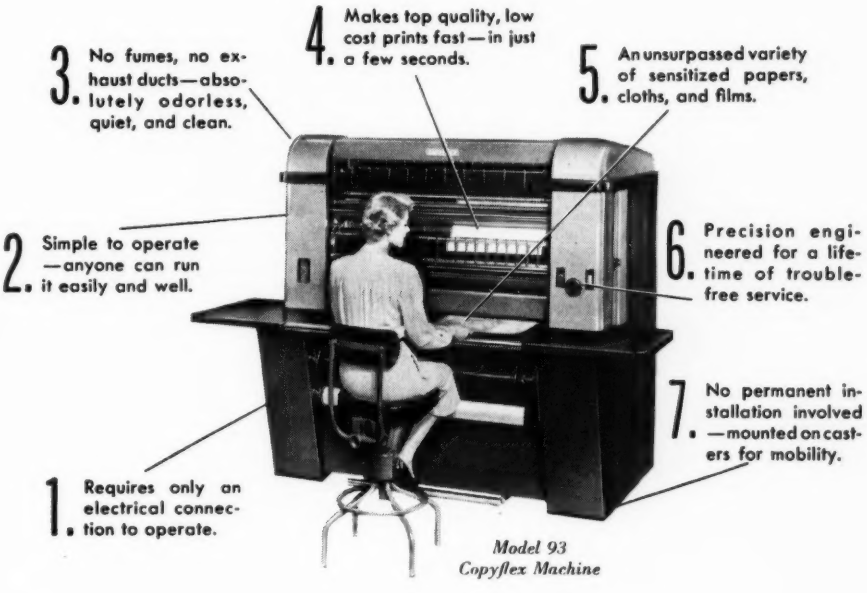
Repeating this deductive multiplication, multiply the "9" multiplier by the "19" we have already established as being the extreme right-hand end of the original number; we find that we will be adding the carried-over "8" when we multiply the newly found "1" by the "9" multiplier. Thus in the second (newly forming) number the next to the last digit is the "7" from "17" (coming from 1 x 9 plus the 8 carryover). Now we have the "1" (from the "17") to carry over. The process goes on by successive multiplication and addition of carried-over numbers. When the "10" forms, we have the required first two digits. If you work out the intervening digits, you will come up with that desired wealth (which is more in dollars than all the debt of all the governments of all the world): 10,112,359,550,561,797,752,-808,988,764,044,943,820,224,719.

## quotes

In our 52 years of existence, we have spent a little over $2.1 billion. A large percentage of that has been spent in the last eight or nine years, so those projects are not yet returning their full share to the Treasury. In spite of this fact, we have collected and put back into the Treasury $510 million, or over 25 percent of the total money we have spent in the last 50 years.... We have less than one percent of delinquencies.... Most businesses would be proud of a record of that type.

—Wilbur A. Dexheimer
Commissioner,
Bureau of Reclamation


# Seven Good Reasons for Specifying Copyflex for Your Next Copying Machine


3. No fumes, no exhaust ducts—absolutely odorless, quiet, and clean.
4. Makes top quality, low cost prints fast—in just a few seconds.
5. An unsurpassed variety of sensitized papers, cloths, and films.
2. Simple to operate—anyone can run it easily and well.
6. Precision engineered for a lifetime of trouble-free service.
7. No permanent installation involved—mounted on casters for mobility.
1. Requires only an electrical connection to operate.

*Model 93 Copyflex Machine*

Why settle for less when it costs no more to own the one machine that offers *all* the benefits of diazo type, positive black-on-white reproduction?

That's what you get with a Bruning Copyflex. You have all the speed, the economy, and the quality associated with positive black-on-white reproduction . . . plus problem-free installation, ease of operation, and absence of fumes, exhaust ducts, ventilating fans, and similar drawbacks.

Today's Copyflex machines represent 25 years of development by men who are thoroughly familiar with engineer prints and print-making requirements. They are made by the Charles Bruning Company, who introduced the diazo type direct process of reproduction in this country in 1929.

There is a Bruning Copyflex that will exactly fit your requirements. Write us for full particulars.

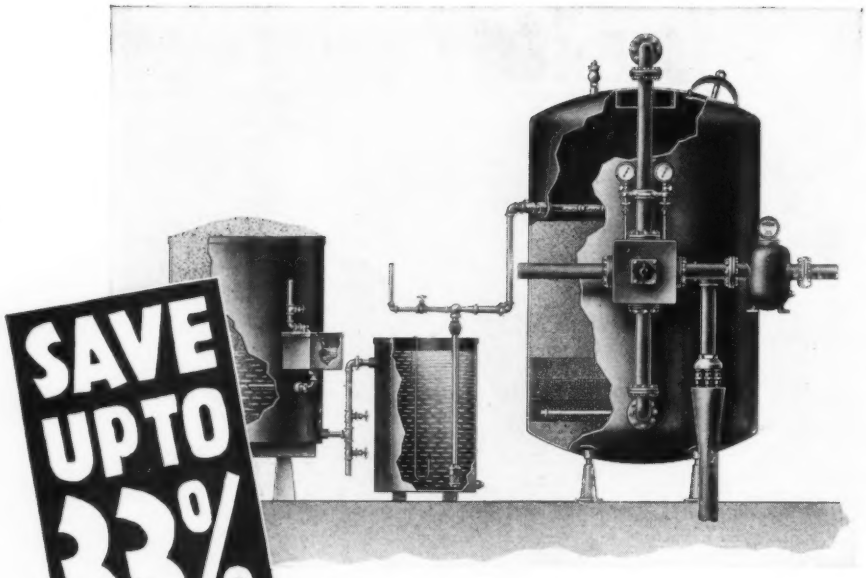
**BRUNING Copyflex**

**Copies anything typed, written, printed or drawn on ordinary translucent paper—in seconds.**

**CHARLES BRUNING COMPANY, INC. • 4700 MONTROSE AVENUE • CHICAGO 41, ILLINOIS**

*Everything for the Engineer and Draftsman*

# AMERICAN CHLORIDE DEALKALIZER




***Another AMERICAN First***

## This is an exclusive AMERICAN process of dealkalizing water at great savings

AMERICAN's New Process reduces alkalinity by chloride anion exchange without the use of acid. Instead of using common salt alone as regenerant, the AMERICAN process utilizes a mixture of salt and caustic, thereby increasing the capacity of the anion exchange resins from 33% to 50% and greatly improving the quality of the effluent.

***Write for bulletin.***

SERVICE SINCE 1902 — TO THE INDUSTRY

**AMERICAN** *Water Softener* **COMPANY**
INCORPORATED

FOURTH AND LEHIGH AVENUE • PHILADELPHIA 33, PENNSYLVANIA

DEAERATORS • HOT PROCESS SOFTENERS • REACTORS • FILTERS • ZEOLITE SOFTENERS • CHLORIDE DEALKALIZERS • AERATORS & DEGASIFIERS
HYDROGEN SODIUM ZEOLITE SOFTENERS • DEMINERALIZERS • CHEMICAL FEEDERS • CONTINUOUS BLOWDOWN • SWIMMING POOL EQUIPMENT


# CE attends

# A Work Study

Chicago's Illinois Tech recently sponsored a Work Study Conference which touched on many fields of interest to consulting engineers.

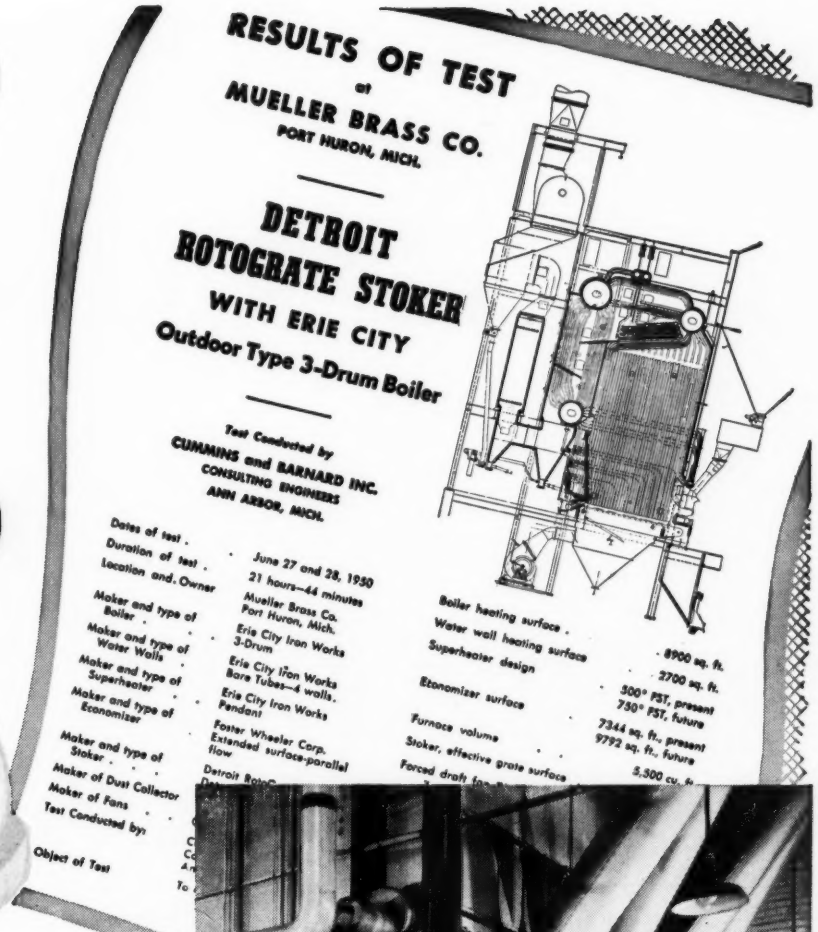
On operations research, Dr. Russell L. Ackoff, Case Institute, said that when a firm buys consulting services, it buys experience as such; when it buys operations research it buys experts who devise methods and operations which will obviate the client's need for future outside assistance in operations research.

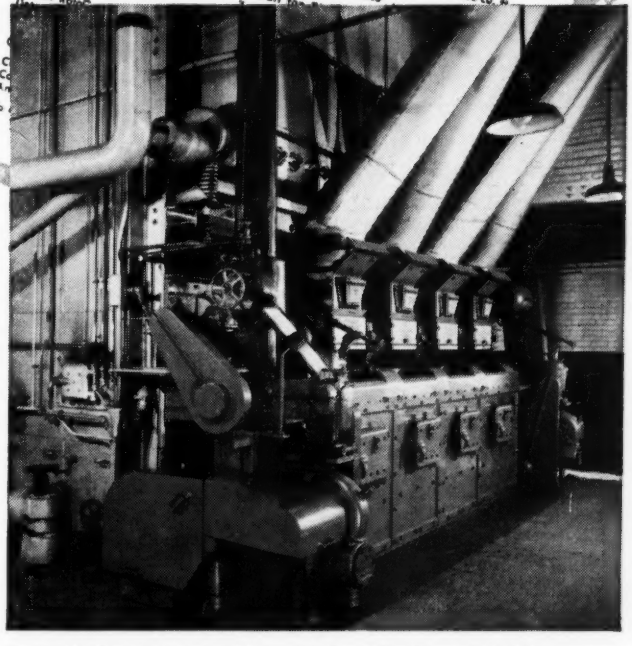
EDWARD C. VARNUM, BARBER-COLMAN; DR. RUSSELL L. ACKOFF, CASE INSTITUTE; DR. T. E. CAYWOOD, CAYWOOD-SCHILLER ASSOCIATES; AND PAUL H. RANDOLPH, ARMOUR RESEARCH FOUNDATION (L. TO R.)

On automation, for example, a panel of experts concluded that although the automatic factory may not yet be here, full automation is a reality in factory operations.

JOHN W. PALMER, BUTLER MANUFACTURING; KENNETH H. BOLDT, EASTMAN KODAK; JAMES CURRAN, BUTLER MANUFACTURING (L. TO R.)

# HIGH EFFICIENCY for Years by TIME TESTED Detroit RotoGrate Stokers



*Detroit RotoGrate Stoker applied to the 110,000 pound unit at Mueller Brass Co., Port Huron, Mich.*

**Results of tests of the Mueller Brass new steam generating unit by the consultants were most gratifying. They are typical of Detroit RotoGrate Stoker performance.**

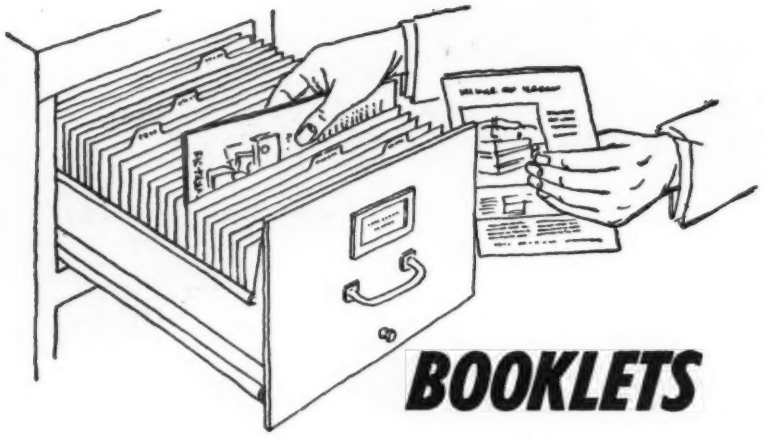
**Especially important to you as a buyer is the *test of time*. Performance records of the RotoGrates in hundreds of plants—show high overall thermal efficiency, high availability and extremely low maintenance with all grades of coal.**

***Write for Detroit RotoGrate Bulletin***

***There is a Type and Size Detroit Stoker for Every Industrial Need***

## Detroit Stoker Company

**General Motors Bldg., Detroit 2, Mich. • Works at Monroe, Mich. • District Offices in Principal Cities**



# BOOKLETS

Personal copies of booklets can be obtained by writing directly to the manufacturers

BOILERS—A handy 16-page reference, bulletin SB-50, describes this company's complete line of steam generating equipment. Sectional views and photographs are used to show various arrangements of equipment with an explanation of advantages and applications. *Erie City Iron Works, Dept. CE, Erie, Pa.*

LATEST DATA on fuel-oil heating and pumping sets are contained in 27-page bulletin OB-53. It outlines the principles used in design and construction and gives a complete form to help engineers in drawing up comprehensive specifications for bidding. Photographs illustrate the various combinations of pumps, drivers, and heaters as well as a wide range of piping arrangements for cross-over controls and suitable locations of valves, gages, and thermometers to suit special unit locations and control requirements. *The Engineer Co., Dept. CE, 75 West St., New York 6, N. Y.*

INSULATION—A 20-page technical data manual gives engineers all available information on Gilsulate insulation for hot underground pipes. How ditch sizes are determined for various pipes and types of soil, how efficiency of the insulation is calculated, and how performance for a particular job can be predicted is explained. Charts, tables, drawings, and graphs are used to simplify and clarify discussion of the engineer's calculations. *American Gilsonite Co., Dept. CE, 134 West Broadway, Salt Lake City, Utah.*

"How To USE Soapstone OCT-O-DUCT—a manual of field practice," eight-pages, is based on field experience with the first million feet of the new flat-sided underground conduit. The manual illustrates methods of preparing trenches, erecting duct structures, and manholes and encasing. Soapstone OCT-O-DUCT is a non-metallic underground conduit for power and communication circuits. *Soapstone Duct Co., Dept. CE, 110 Linfield Dr., Menlo Pk., Calif.*

SERVICES—Twenty-four page book "DFI Facilities," describes the diversified engineering research and development which is being carried on by this company's technical staffs. Four main services; technical surveys, research and development, design engineering, and production

3355 square foot heater with desuperheating, condensing, and sub-cooling sections.

Integral forged channel and tube sheet showing pass separations.

THERE IS A DIFFERENCE IN FEED WATER HEATERS

Wherever a high pressure extraction heater is required — in power plants, central stations, or district heating companies — it's wise to specify a Whitlock Feed Water Heater. The unique Whitlock "Pres-seal" front closure completely eliminates heavy cover bolting — the hydrostatic load effects its own seal. This "Pres-seal" design pays off in dependability, efficiency, and economy of operation. Standard designs include both U-tube and straight tube constructions and are suitable for combinations of desuperheating, condensing, and sub-cooling.

Whitlock Feed Water Heaters accommodate the full range of pressures — whether 1000 or 2,500 psig. Ask us for performance data — find out for yourself why leading industries and public utilities insist on Whitlock. Write for complete details.

**The Whitlock Manufacturing Co.,** 96 South St., Hartford 10, Conn. New York, Philadelphia, Boston, Detroit, Chicago, Richmond. Authorized representatives in other principal cities. In Canada: Darling Brothers, Limited, Montreal.

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As a Consulting Engineer whether your client has to or needs to or just wants to collect dust efficiently and economically because it's good public relations to do so, Prat-Daniel Dust Collectors are the difference between black and **white** .

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The smaller the diameter of the tube the greater the centrifugal force on the dust particles . The greater the centrifugal force the higher the efficiency of the dust collector.

That's why when quality and results are the determining factors it pays to specify **pd** Collectors. Why not contact The Thermix Corporation, Project Engineers for Prat-Daniel, specialists in this field?

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POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks.

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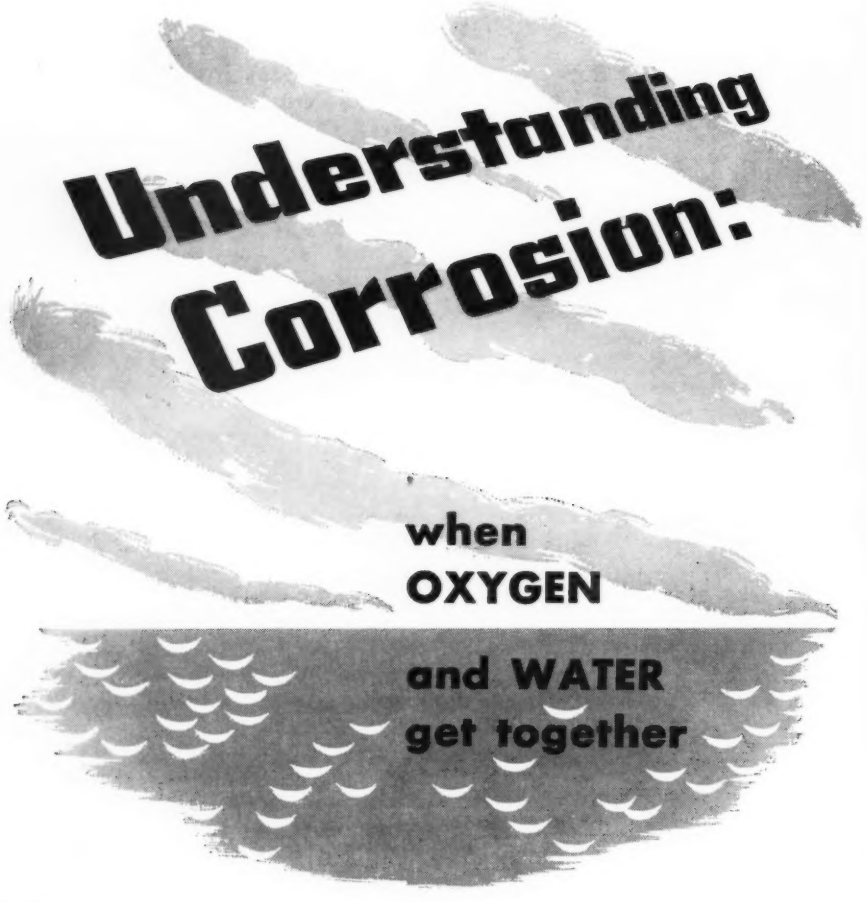


When free oxygen combines with atmospheric moisture or natural waters, the stage is well set for corrosive action. Controlling the degree and extent of that action are many related factors, variable in influence under differing circumstances.

The rate at which oxygen is transferred from atmosphere to a solution is, for example, directly proportional to the amount of exposed surface area of that solution, while the corrosion rate of immersed metal is, in turn, proportional to the oxygen concentration of the solution. Therefore, with all other factors stabilized, a reduction in exposed surface area will slow the oxygen-solution process, thereby greatly retarding corrosion.

How deeply metal is immersed, particularly in a quiet solution, is another determinant of corrosive action in which dissolved oxygen is the governing factor. Oxygen saturation, highest at and near the surface, diminishes with increasing depth as convection currents become less active. Corrosion at and immediately below the surface of a liquid is therefore far more severe than that encountered at greater depths.

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THE DAMPNEY COMPANY

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## BOOKLETS —*Starts on page 70*

engineering, are typified in the pages describing client engineering projects. The project manager system and operating policies are explained in chart form. *Designers for Industry, Inc., Dept. CE, 2915 Detroit Ave., Cleveland 13, Ohio.*

CORRUGATED ROOFING and siding of steel coated with a rust inhibiting asphaltic bond coat and an asphaltic-plastic, mica coating is fully described in four-page folder 4b/PL. Cross T-bar and T-bar and saddle construction are pictured and a list of standard styles and coverage dimensions is included. Fasteners and flashing are illustrated. *Plasteel Products Corp., Dept. CE, Washington, Pa.*

SWITCHGEAR—bulletin 7004 B is a 24-page guide to I-T-E high voltage switchgear. Illustrated with diagrams and photographs, it contains separate sections on features, switchgear components, applications, specifications and construction data. Detailed information is tied in with easy-to-see photographs and diagrams. Booklet also deals with extra services which are available to users of switchgear. *I-T-E Circuit Breaker Co., Dept. CE, 19th and Hamilton Sts., Philadelphia 30, Pa.*

GEARED TURBINE GENERATORS, 200 to 1500 kw, for both ac and dc service are the subject of 23-page bulletin 1969. Engineering and construction features, including two types of governing arrangements, hand and automatic nozzle controls, and other controls and accessories are described in detail. *Worthington Corp., Dept. CE, Harrison, N. J.*

INTAKE AIR FILTERS for stationary and portable engines and compressors described in four-page folder 135-5M feature a flocked screen wire filtering media. How this filter maintains constant rated efficiency is explained. Drawings and tables show specifications. *American Air Filter Co., Inc., Dept. CE, Louisville 8, Ky.*

"TRENDS in Swimming Pool Design," 20-page booklet will prove especially helpful to engineers, architects, and those contemplating pool construction or modernization. It covers various types of construction; modern trends in pool lighting; color in the pool; data on filtering, recirculating and chlorinating systems; and newest developments in pool fittings and accessories. *Elgin-Refinite, Swimming Pool Dept., Dept. CE, Elgin, Ill.*

"INSULATION ROOF BOARD," seven-page technical bulletin 593, explains

# STARTLING NEW FACTS ON EXPANSION JOINT MAINTENANCE

*It may cost less than you think to service expansion joints.* Look at these records from three typical users of Yarway Gun-Pakt Expansion Joints:

To add packing to a Yarway Gun-Pakt joint, just insert a slug and twist a wrench; the joint is tight, the job done. *There is no unpacking operation.*

| | YARWAY GUN-PAKT JOINTS | CONVENTIONAL GLAND-PACKED JOINTS |
|---|---|---|
| STATE UNIVERSITY* | Required addition of only 3 slugs (45 cents) of packing in 5 years. Lubrication only once every 6 months. Total labor time of only 2 manhours in 5 years. | Same lubrication as Gun-Pakt, *plus* gland tightening, *plus* complete overhaul with shutdown for unpacking and repacking every 3 to 4 years. Time for overhaul—25 manhours per joint! |
| MID-WEST AIRFIELD* | Only maintenance was lubrication and addition of 2 slugs (30 cents) of packing per year. Total labor ¼ manhour per joint per year. | Lubrication and gland tightening required 8 manhours per joint per year—plus complete unpacking and overhaul every 2 to 3 years. Time required for overhaul—20 manhours per joint. |
| "BIG TEN" UNIVERSITY* | Lubrication only once every 2 months, with packing added as needed. Total labor time charged, 1 manhour per joint per year. | General maintenance requires 6 manhours per joint per year. Complete overhaul required every 2 to 3 years with unpacking and repacking—24 manhours per joint. |

*Names on request.

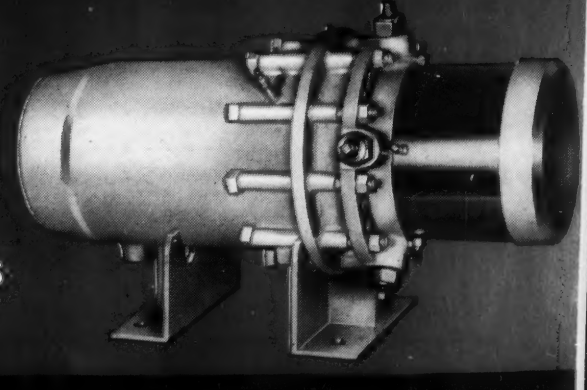
To get the full facts on Yarway Gun-Pakt Expansion Joints, and how they can save you maintenance money, write for Yarway Bulletin EJ-1913.

**YARNALL-WARING COMPANY**
**196 Mermaid Ave., Philadelphia 18, Pa.**

YARWAY

**gun-pakt expansion joints**

Yarway single-end, welding type Gun-Pakt joint for pressures to 300 psi, heavier design for higher pressures. Single-end traverses up to 12 inches; double-end up to 24 inches.



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ASSEMBLING ELECTRONIC PARTS

**FOR YOUR COMFORT**
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**FOR TESTING MACHINES OR MATERIALS AT ANY TIME OF THE YEAR**

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● This Niagara "Controlled Humidity" method gives you the **MOST EFFECTIVE** Air Conditioning because its cooling and heating functions are made completely separate from adding or taking away moisture. This assures you always a precise result. No moisture sensitive instruments are needed.

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**EASIEST TO TAKE CARE OF.** The machine is accessible, the control circuits are simple and easy to operate, and there are no solids, salts or solutions to be handled.

**MOST COMPACT.** It does a very large amount of work in a small space.

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*Niagara District Engineers in Principal Cities of U. S. and Canada*


## BOOKLETS

—*Starts on page 70*

how proper installation of this board between the vapor barrier and roofing finish material will eliminate the danger of condensation. Full-page tables list coefficients of heat transmission of flat roofs covered with built-up roofing. *National Gypsum Co., Dept. CE, Buffalo 2, N. Y.*

"A PICTURE STORY of the R. C. Mahon Company," 46-page brochure, portrays the company's extensive metal fabricating and production facilities, its products and services. Activities, products, and production methods of the eight divisions are pictured. *The R. C. Mahon Co., Dept. CE, 6565 E. Eight Mile Rd., Detroit 34, Mich.*

THE STORY of Octa-Tubes, advanced lighting standards for streets, highways, and bridges, is told in 11-page bulletin OTA. Features and installations are pictured for the modern Elite, the conventional long-span, parkway, and fluorescent types. Base construction details are presented for each type along with drawings of accessories and modifications. *Millerbernd Manufacturing Co., Dept. CE, Winsted, Minn.*

Q-FLOOR CONSTRUCTION utilizing cellular steel beams which are said to combine the inherent qualities of steel — light weight and great strength—are described in 23-page brochure Q-20-54. The booklet is indexed as to types, properties, specifications, and other engineering data. Pictures and scaled drawings are used to advantage in explaining means of installation and advantages. *H. H. Robertson Co., Dept. CE, 2407 Farmers Bank Bldg., Pittsburgh 22.*

CHEMICAL PROCESS industry equipment is presented in a 15-page condensed catalog. Each section of the indexed booklet gives complete information, applications, and colored flow diagrams for a specific product. A broad range of sizes, materials, and types for standard and special requirements are shown. *Schutte & Koerting Co., Dept CE, 12th & Thomas Sts., Philadelphia, Pa.*

LARGE CAPACITY blower fan unit heaters for industrial and commercial building interiors are presented


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Engineering . . . materials . . . erection help! These are three ways Bigelow-Liptak can help refineries in the design of castable linings for regenerators and other petro-chemical furnaces. It all adds up to one-source efficiency —continuous on-stream service.
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Boiler enclosures utilize Bigelow-Liptak unit-suspended thin walls in convection areas and behind water walls where low temperatures prevail. Where more severe conditions are encountered, thicker construction or tube-supported walls are recommended. Result: less down time . . . greater efficiency.
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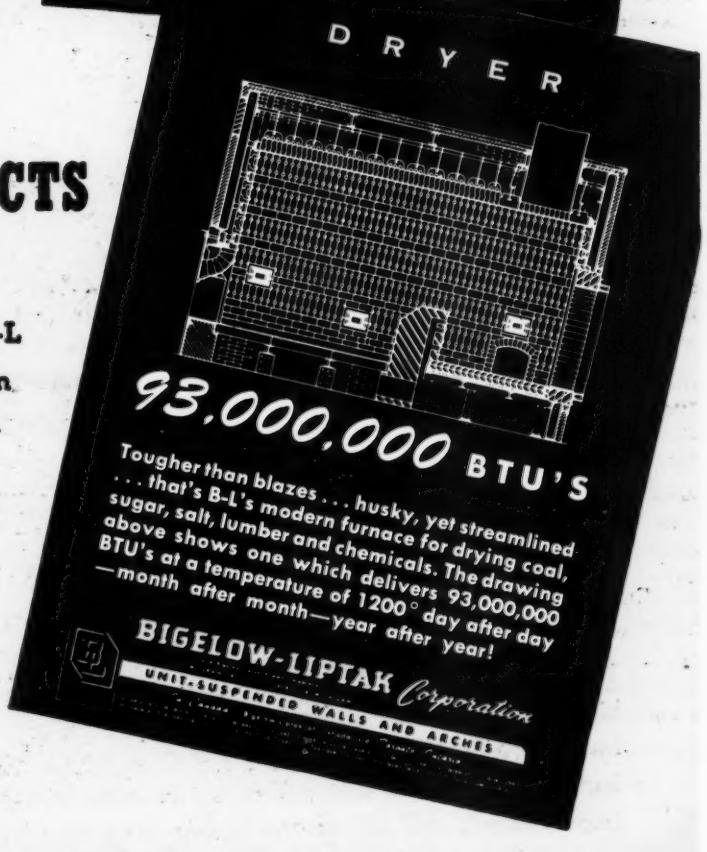
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Tougher than blazes . . . husky, yet streamlined . . . that's B-L's modern furnace for drying coal, sugar, salt, lumber and chemicals. The drawing above shows one which delivers 93,000,000 BTU's at a temperature of 1200° day after day —month after month—year after year!
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**There are many, many applications for B-L furnace construction throughout industry. In steel mills, power houses, refineries and petro-chemical plants, sugar mills, coal mines, glass plants, city incinerators—anywhere in the heat of things—you'll find B-L installations. They're hanging up new records every day—providing top performance at a lower cost per BTU. You can get more information if you write—*today!***

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## BOOKLETS —*Starts on page 70*

by means of drawings, photographs, and indexed text in 39-page bulletin WN-135. Tables, graphs, detail drawings of various arrangements, and piping and control diagrams make this booklet a must for anyone specifying large unit heaters. *John J. Nesbitt, Inc., Dept. CE, Philadelphia 36, Pa.*

HEAT EXCHANGERS—Of particular interest to engineers involved in the design and application of heat exchangers and condensers, folder TB 329A lists the analyses and mechanical properties of 29 carbon, alloy, and stainless tubing steels used in various types of heat exchangers and condensers. Additional data presented in other tables include reference specifications and applications information. *The Tubular Products Div. of Babcock & Wilcox Co., Dept. CE, Beaver Falls, Pa.*

MUNICIPAL WATER conditioning equipment for the removal of hardness, turbidity, color, organic matter, taste, odor, iron, and manganese from water supplies by both high-rate and conventional systems is described in 11-page bulletin WC-113. Schematic diagrams and pictures show the design and operating principles of the Graver Reactivator. It also includes descriptive matter on a complete line of feed-water softening and deaerating units for municipal steam power generating stations. *Graver Water Conditioning Co., Div. of Graver Tank & Mfg. Co., Inc., Dept. CE, 216 West 14th St., New York 11, N. Y.*

"THE LJUNGSTROM Air Preheater," 36-page booklet, explains the fuel savings and increased performance made possible by using waste heat in flue gases to preheat incoming combustion air. It contrasts regenerative with recuperative preheaters, and explains the operating principle and structural details and advantages of a gas-to-gas preheater of the continuous regenerative type. Industrial applications for other than power boilers are covered. *Air Preheater Corp., Dept. CE, 60 E. 42nd St., N. Y. 17, N. Y.*

"TAYLOR FORGE," Vol. 1, No. 2, 40-pages, includes the essential material from recently approved ASAB


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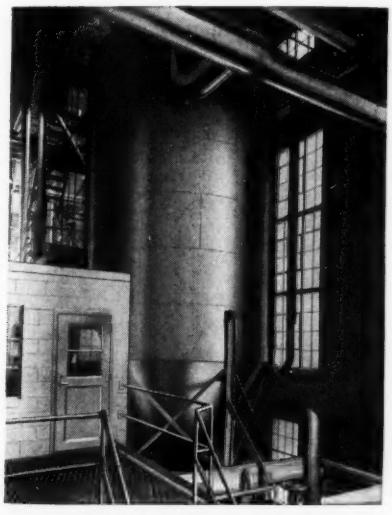
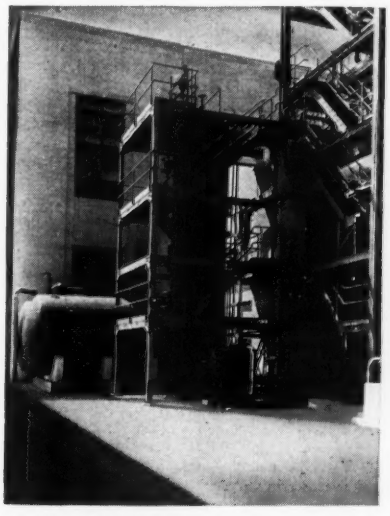
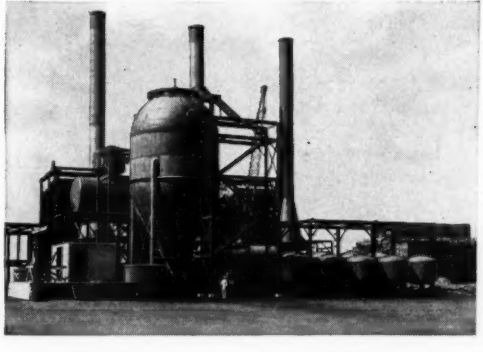
Belco-designed equipment provides high operating efficiency at low operating costs. Many of the country's largest industries rely on Belco for their water conditioning equipment. For example, Belco has built the largest fully automatic demineralization plant in the world and is currently furnishing one of the largest hot lime zeolite installations. A consultation with Belco could lead to lower operating costs for you, too. Write or call for technical assistance at any time.



**HOT LIME SODA** — Installation in boiler house at large eastern oil refinery. Has capacity of 200,000 lbs/hr.



**HOT LIME SODA** — Installation in large southwestern utility. One of three units with 90,000 lbs/hr total capacity.



**HOT LIME BELCOLITE** — Installation at large southern chemical company. Capacity 600,000 lbs/hr. This plant embodies "thoroughfare" operation of separate deaerator and hot process tank. The large hot process tank was designed, built and erected by Belco under its contract with customer.

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*Boiler Feedwater Heaters • Water Softeners • Filters • Clarators Demineralizers • Automatic Process Control Panels*

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# Now you can have the advantages of USCOLITE* in your valves as well as in your piping

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Developed to supplement Uscolite* pipe and fittings, the new Uscolite bodied Hills-McCanna Diaphragm valve, now makes it possible to utilize Uscolite's advantages throughout your piping layout. The unique Saunders patent design of the valve coupled with the chemical resistance of Uscolite makes the valve ideal for plating, water treatment, and in the manufacture of fertilizer, bleach, storage batteries, pulp and paper, etc.

The Hills-McCanna Uscolite bodied valve is available in standard sizes from ½" through 2". It is suitable for pressures to 150 psi and for temperatures to 170° F. (at some sacrifice of pressure rating in larger sizes).

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- Working parts isolated from flow.
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**HILLS-McCANNA**

*saunders patent diaphragm valves*

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Chemical Proportioning Pumps • Force-Feed Lubricators
Magnesium Alloy Sand Castings


## BOOKLETS —Starts on page 70

16.5-1953, which covers pressure-temperature ratings for steel pipe flanges and flanged fittings. Included also are reviews of recent articles, engineering papers, and standards on problems of piping and pressure vessel work. *Taylor Forge & Pipe Works, Dept. CE, P. O. Box 485, Chicago 90, Ill.*

CHEMICAL CLEANING service for industrial equipment is explained in this four-page folder. How the service works, applications, and results to be expected are described. *Dowell Inc., Dept. CE, Tulsa 1, Oklahoma.*

SPECIAL EMERGENCY electric generating plants that meet the rigid code of approval of the Pennsylvania Industrial Board, both gas and gasoline driven models, are illustrated in sizes ranging from 1000 to 30,000 w ac in six-page folder A-345. Specially designed Line Transfer Controls which make operation of the standby plants completely automatic are shown. *D. W. Onan & Sons Inc., Dept. CE, Minneapolis 14, Minn.*

V-BELT DRIVES—Six-page bulletin 20B6956B provides in condensed form the necessary information on the new method of calculating the horsepower capacity of a "Texrope" V-belt drive. Ratings resulting from this method take into consideration effect of belt length, ratio of the diameters of both the driving and driven sheaves upon the horsepower rating of the belt, and resultant belt life for both standard construction and high capacity "Texrope" V-belts. *Allis-Chalmers Manufacturing Co., Dept. CE, 948 S. 70th St., Milwaukee, Wis.*

MOVABLE-BRIDGE electrification booklet GED 1982, 12-pages, explains why nation's automobile and railroad traffic growth necessitates new movable bridges. Amply illustrated, it contains case histories of various bridge applications. Information on amplidyne-control, electrically operated center-span drives, and interlocked control also is provided. *General Electric Co., Dept. CE, Schenectady 5, N. Y.*

PUMPS AND COMPRESSORS—How this company's industrial equipment can be used in many different types of industry is explained in 15-page reference bulletin WP-1099-B61. Special features, types, sizes, and capacities of products from condensers and coolers to rotary and centrifugal pumps are listed and pictured in actual installation photographs taken at steam power plants, refrigerating plants, and others. *Worthington Corp., Dept CE, Harrison, N. J.* ▲▲

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**Social Security**

*—Starts on page 20*

alone from the standpoint of information contained in it, but to learn the Chamber's official position on the Social Security Act. The Chamber is at times influential in legislation, and right now it is very decidedly in favor of universal Social Security coverage. For copies of their book write to the Economic Research Department, Chamber of Commerce of the United States, Washington 6, D.C.

Finally, whether the professional engineer, among other professions, is drawn into Social Security this year or not, it is almost sure that he will be eventually. Universal coverage seems on its way. This view is based not only on a regard for the nation's responsibility to its aged, but on the practical financing aspects of the Old-Age and Survivors Insurance and Old-Age Assistance programs under Social Security. In present financing and operation of the Act there are seen several weaknesses. The correction of these is stated as an imperative necessity by leaders in government and industry, and they see it as being largely accomplished by making the system self-supporting, eliminating federal grants to the states for the program, and bringing all gainfully employed under universal coverage.

Since inclusion appears inevitable, the professional worker's main effort must be aimed at trying to influence improvement of the earnings after retirement limitation. And even though the legislation seems stacked against him for this session of Congress, he can find a glimmer of hope in President Eisenhower's message on Social Security presented to Congress in January. The President's view was that people over 65 years of age who can work should be encouraged to do so and should be permitted to do so without losing their benefits. This proviso in the present law, he stated, imposes an undue restraint on enterprise and initiative. "Retired persons should be encouraged to continue their contributions to the productive needs of the nation," said the President, and "I am convinced that the great majority of our able-bodied citizens are happier and better off when they continue in some productive work after reaching retirement age. Moreover, the nation's economy will derive large benefits from the wisdom and experience of older citizens who remain employed in work commensurate with their strength." ▲▲


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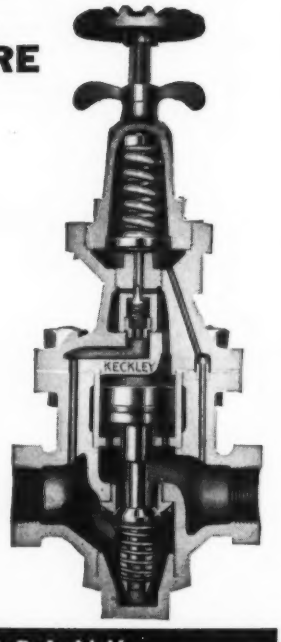


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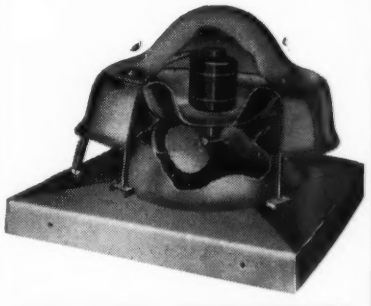

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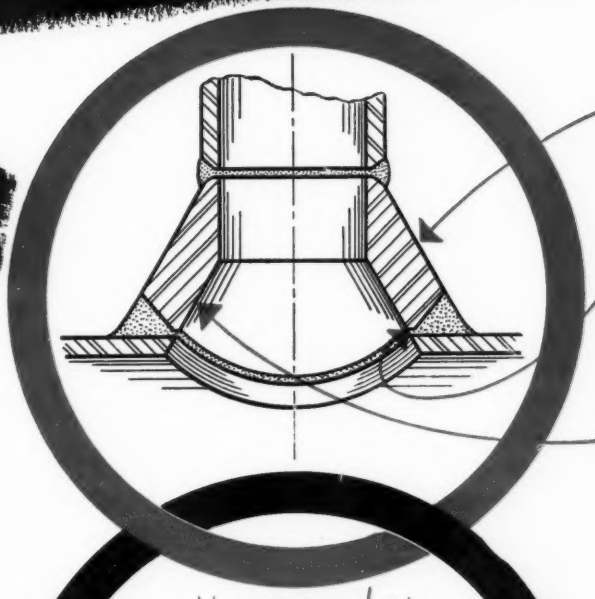

Designed with thick, tapered section to relieve stress concentration.

Additional metal prevents branch connection from corroding dangerously thin.

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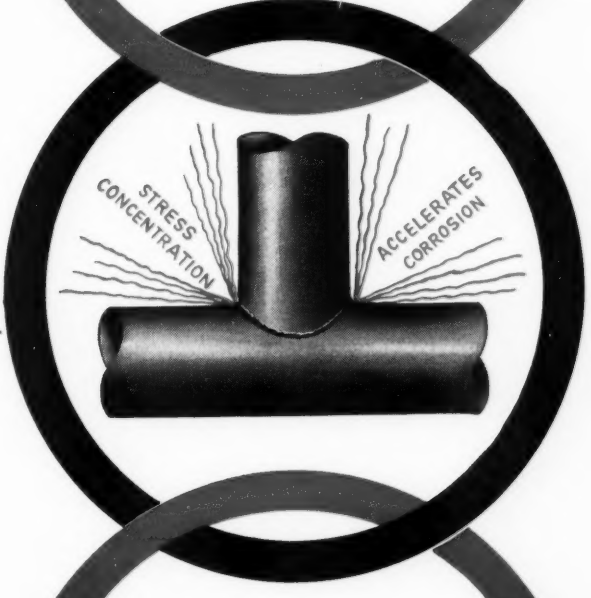


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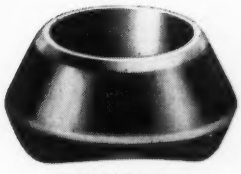

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## Public Power

*—Starts on page 23*

the State Public Service Authority; in the South also is Texas' Lower Colorado River Authority. The LCRA grew up in the 1930's parallel with the TVA, and now carries on flood control, soil conservation, and power supply services for several communities spread diagonally across Texas.

### Dewey Acts on St. Lawrence

Historically, one of the earliest of the state power programs arose in New York in 1907 when Republican Governor Charles Evans Hughes launched his policy of "progressive development of the water power of the state under state ownership, control, and maintenance." By merely citing his Republican predecessor's views in 1931, Democratic Governor Franklin Roosevelt finally secured the establishment of the Power Authority of the State of New York. And, bearing in mind New York's public power predilections, Republican Governor Thomas Dewey restrained the Republican Congress in 1953 from handing over the State's power potential in the St. Lawrence River to private utility development.

Municipal, state, cooperative, and other local public power systems have been especially aided and abetted by the federal program of public power preference. Under a long series of federal laws, these locally owned public power systems have been given priorities and preferences in the purchase of government power from federally owned generating projects. This preference policy, like our other public power policies, goes back to the year 1906; since that time it has been widely supported by Republicans and Democrats alike.

Today more than 40 percent of our federally generated power goes preferentially to municipals, cooperatives, and other public power agencies. Over 30 percent is sold directly by the government at wholesale rates to large industrial plants, mainly engaged in defense production, and to atomic energy projects. About 20 percent is left for the private utilities for resale to their customers.

### Private Utilities Vigorous

The private utilities have retained some 80 percent of the nation's electrical distributing business, although they generate only about 77 percent of the nation's power. It is clear, then, that although public power expropriated the private utilities in some areas and elbowed them out in others during the last 50 years, these investor-owned enterprises show a lasting vigor of their own.

Under the dynamic conditions of the American political economy, there seems to have been room so far for both private and public forms of utility organization. Since the end of World War II, the private utilities have in fact, been able to double their investment in plant and equipment. Average earnings of their common stock and bonds are, for the present at least, slightly higher than 1939 rates. Moreover, they have been given the advantage of liberal tax exemptions and amortization provisions as part of the post-war defense production program.

This has been one of the answers of the public power advocates to the claim of the private utilities that tax exemptions of public projects have not been fully covered by public payments "in lieu of taxes", that government loans for public projects have been made at interest charges that are too low, or that public power rates have been kept artificially below actual cost of production.

### Dressing-Up Balance Sheets

Public ownership advocates often respond to each of these assertions on their merits, but no statistical evidence is likely to put an end to this indecisive debate as to whether public power is a yardstick or a birch-rod for the private utilities. "Dressing up the balance sheet" has been a frank technique in the utility business for some years, and there is no reason to expect us to entirely forego this favorite pastime at once merely because we are transferring some of our power investments from our private to our public portfolio.

Nevertheless, it is also apparent that our public projects have become more self-liquidating, more tax-paying, and more interest-bearing during the most recent decade of public power development. More rigid standards of governmental financing and accounting are being applied to publicly owned enterprises. Increasingly, their books are being audited, as in the case of our private utilities, by our most reputed accounting firms; they are coming to be models of financial accountability.

### Test of Public Power

This may not settle all of our controversial questions of public and private power, but we are learning the lesson that the test of public power in this generation, as in the case of private power in the last, is the strict allocation of rates, costs, and earnings to the consuming, the tax-paying, and the investing public.

Judging by the past and looking forward to the future, engineering efficiency along with sound economics and responsible policies will be decisive in the developing relationship between public and private power. This means that engineers and managers must comprehend and interpret emerging trends of all kinds in the power field—administrative as well as technical, political as well as economic, atomic as well as electric. ▲▲

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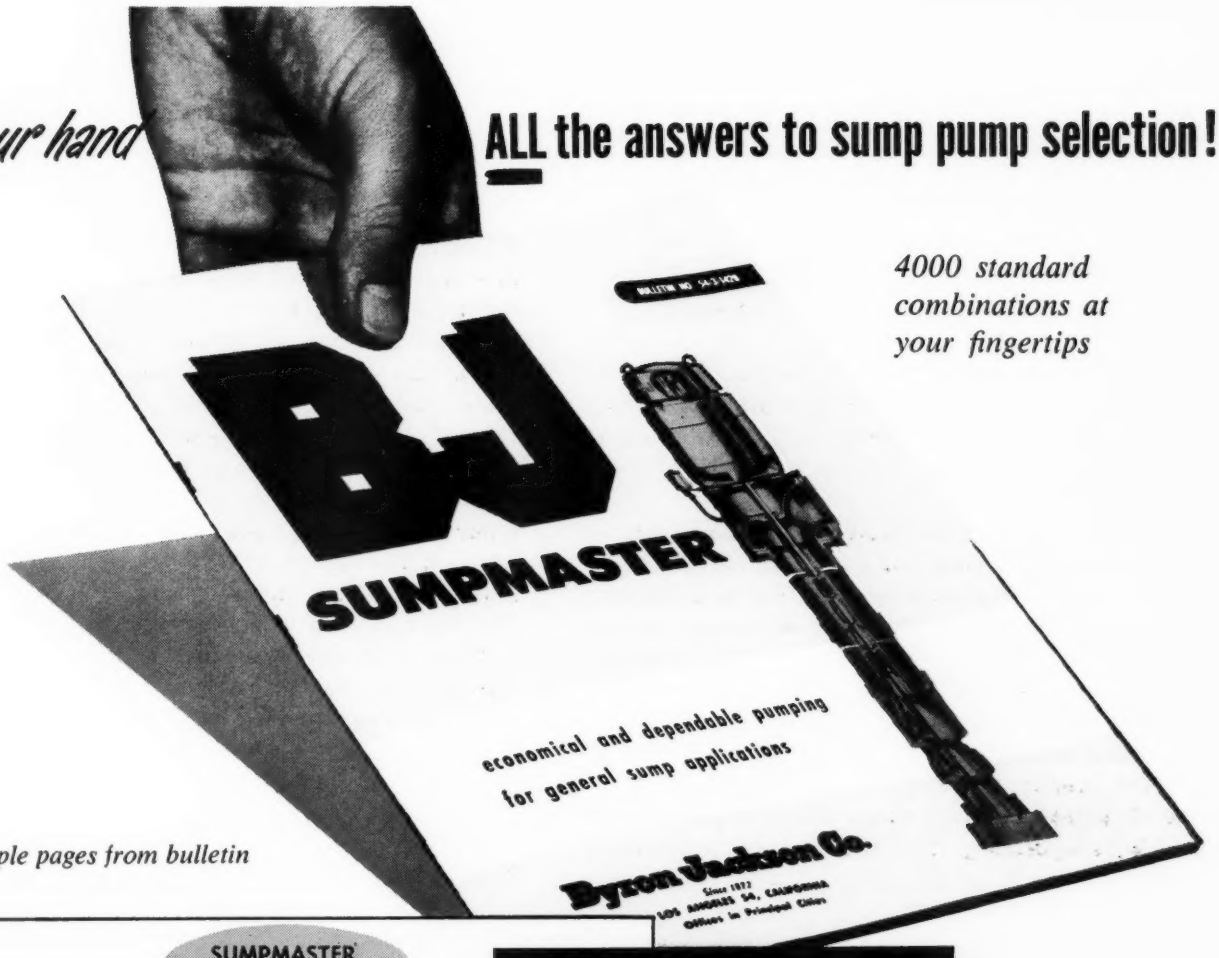


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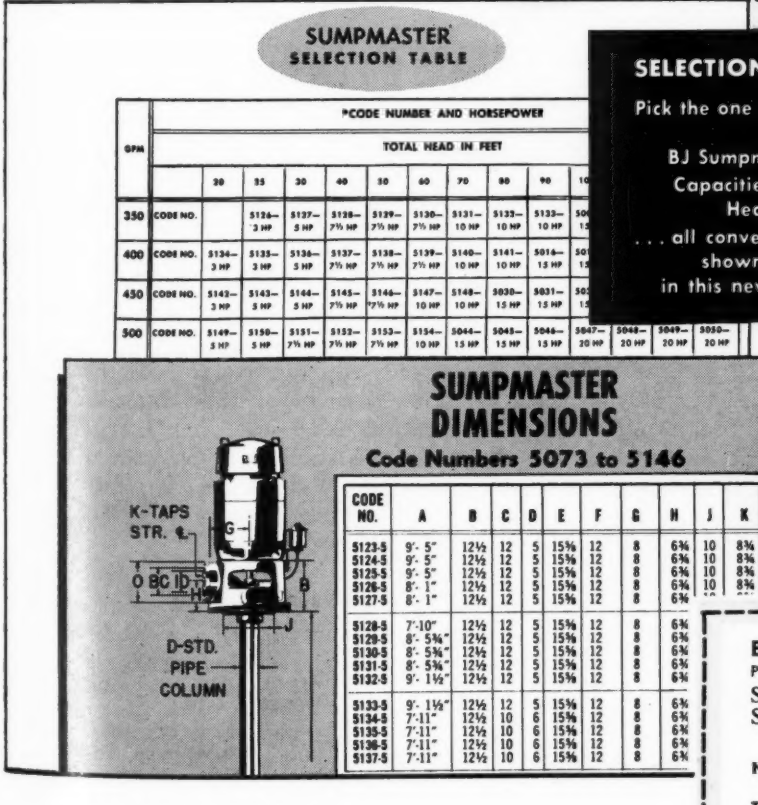


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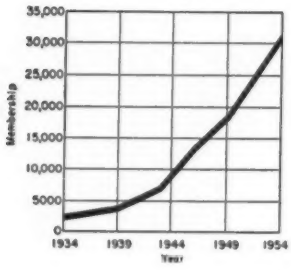



## NSPE for Action

—*Starts on page 38*

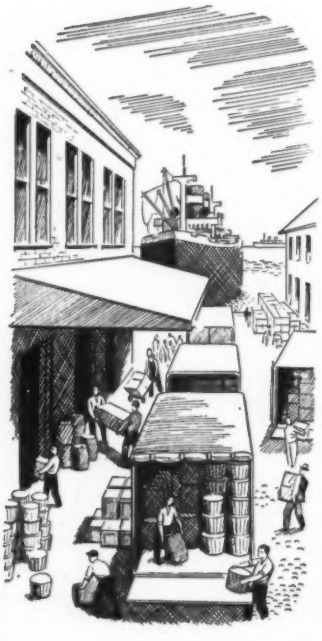
pieces of legislation of interest to the engineering profession, to express the opinion of its membership before Congressional committees, and to continue its liaison with Federal officials on matters of engineering importance.

Several years ago the Society embarked upon an extensive public relations program on behalf of professional engineers. This program will be continued and expanded, focusing attention on the contribution of the engineering profession to the economy of our country. One of the activities in this direction has been the development of National Engineers' Week to take place each year during the week of George Washington's Birthday. During this week, local chapters of the professional society, cooperating with many other engineering groups, concentrate publicity on the engineering profession through hundreds of radio and television programs, special supplements of the daily press, articles in magazines, engineering displays, and special convocations and meetings.

To be of greater service to engineers in industry and to industry itself, the Professional Engineers Conference Board for Industry was created in 1951. The Board has been engaged in research concerning a number of pressing problems of the profession, and has thus far prepared three pertinent reports. The first, on engineering-management communications, and the second on improved utilization of engineers, have been widely reviewed in the technical and business press and have been utilized extensively by industry, government, and other users of engineering services. The third report, on the subject of How to Retain and Attract Engineering Talent, was released very recently and has had even wider distribution and review.

These reports are but one of the Society's extensive services for the Engineer in Industry. A recently created committee is now developing a broad program aimed at research, report, publicity, and policy recommendations for professional engineers in this phase of engineering work.

One of the most pressing problems facing the profession at the present time—and receiving a con-

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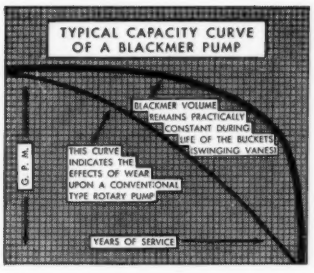
siderable amount of attention—is that of collective bargaining for engineers. The National Society of Professional Engineers has taken the position that the regimentation inherent in unionization activities is incompatible with professional development. As a result, the Society has now embarked upon a program of investigation, reporting, and the resolution of some of the major problems in this field.

In addition, NSPE is very active in the fields of education, ethical practices, military affairs, employment practices, Civil Service activities, architect-engineer negotiations, policies with respect to competitive bidding, and other problems of the professional engineers. From experience, NSPE finds that the vast fields of activity which need further action require the entire efforts of an organization at the professional level, such as NSPE.

The engineer has two sharply defined aspects to his professional development. One is his technical competence. Obviously, he must be well qualified technically if he is to perform the public service which will merit professional stature. However, as the late Dr. Wickenden said, "It is the Second Mile, over and above that of compulsory activity, which distinguishes the true profession from that of a trade." It is to this professional activity that NSPE is dedicated, in the belief that engineers need both their technical society and their professional society for well-developed professional maturity. ▲▲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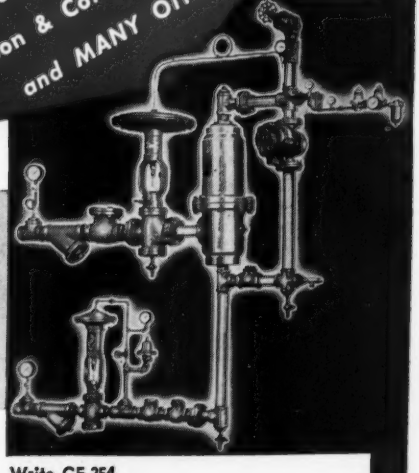

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## Regulators or Capacitors

—*Starts on page 34*

capacitors on when the regulator reaches its maximum raise position. The capacitors then remain on until the regulator reaches its maximum lower position. This can be accomplished by using the limit switches in the regulator mechanism. Such installations gain the benefits of reduced kva and reduced losses which are possible with capacitors plus the narrow, accurate plus-or-minus one-volt band width obtainable in present-day modern voltage regulators.

**TABLE 1**

**EQUI-COST DISTANCES FOR 10 PERCENT VOLTAGE CORRECTION ON DISTRIBUTION CIRCUITS WITH REGULATORS OR CAPACITORS**

| *Line Voltage = 2500v* | | *Line Voltage = 5000v* | | *Line Voltage = 8660v* | |
|---|---|---|---|---|---|
| ***Circuit Load*** | ***Equi-Cost Distance*** | ***Circuit Load*** | ***Equi-Cost Distance*** | ***Circuit Load*** | ***Equi-Cost Distance*** |
| 500 kva | 1.4 miles | 750 kva | 4.2 miles | 750 kva | 8.6 miles |
| 750 | 1.3 | 1000 | 4.6 | 1000 | 8.1 |
| 1000 | 1.4 | 1500 | 2.0 | 1500 | 9.1 |
| 1500 | 0.6 | 2000 | 1.8 | 2000 | 5.3 |
| 2000 | 0.6 | 2500 | 1.9 | 2500 | 5.2 |
| 2500 | 0.6 | 3000 | 1.9 | 3000 | 4.9 |
| 3000 | 0.5 | 3750 | 1.7 | 3750 | 4.5 |
| | | 5000 | 1.6 | 5000 | 4.2 |
| | | 6000 | 1.4 | 6000 | 3.9 |
| | | | | 7500 | 3.3 |
| *Line Voltage = 4330v* | | *Line Voltage = 7620v* | | *Line Voltage = 12,470v* | |
| ***Circuit Load*** | ***Equi-Cost Distance*** | ***Circuit Load*** | ***Equi-Cost Distance*** | ***Circuit Load*** | ***Equi-Cost Distance*** |
| 750 kva | 2.7 miles | 750 kva | 9.0 miles | 750 kva | 14.6 miles |
| 1000 | 2.5 | 1000 | 7.7 | 1000 | 16.3 |
| 1500 | 2.8 | 1500 | 8.7 | 1500 | 14.8 |
| 2000 | 1.5 | 2000 | 4.0 | 2000 | 16.0 |
| 2500 | 1.5 | 2500 | 4.2 | 2500 | 16.9 |
| 3000 | 1.4 | 3000 | 3.9 | 3000 | 9.3 |
| 3750 | 1.4 | 3750 | 3.8 | 3750 | 10.3 |
| 5000 | 1.2 | 5000 | 3.4 | 5000 | 9.2 |
| | | 6000 | 3.1 | 6000 | 8.5 |
| | | 7500 | 2.8 | 7500 | 7.7 |

*Regulators are more favorable for shorter distances, capacitors for longer distances

**TABLE 2**

**SELECTION CRITERIA**

| ***Points to Consider*** | ***Modern Regulator*** | ***Voltage-Controlled Switched Capacitors*** |
|---|---|---|
| Band width | Plus or minus 1 percent or less | Five percent or greater |
| Step size | 5/8 percent | Usually several percent |
| Circuit power factor | Not important | Capacitors may cause leading power factor |
| Losses | Unchanged except for regulator losses | *Probably reduced |
| R/X ratio | Not important | May limit effectiveness of capacitors |
| Circuit demand | Unchanged | *Probably reduced |

*NOTE: Losses and circuit demand may be increased if power factor is made sufficiently leading.

## CE quotes

*There has been a great blossoming of the biological sciences. They are moving out of empiricism into logical order . . . In the whole field of biological applications a dam is about to break, and a surge forward is ready to occur, just as in the physical sciences the fundamental discoveries of centuries finally led to the present day of thermionic tubes, transistors, television, atomic energy.*

Vannevar Bush
President, Carnegie Institution of Washington

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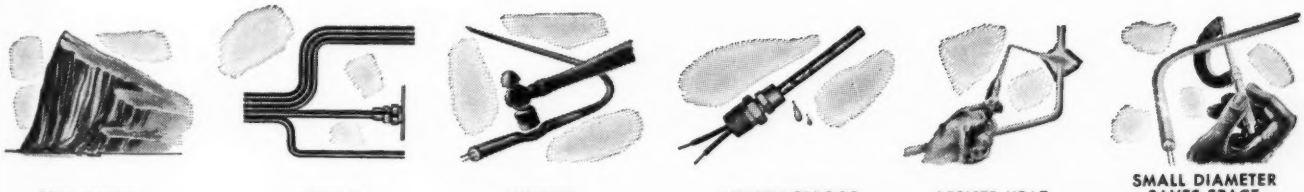

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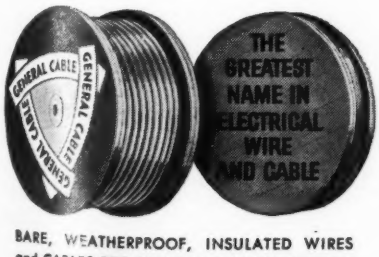


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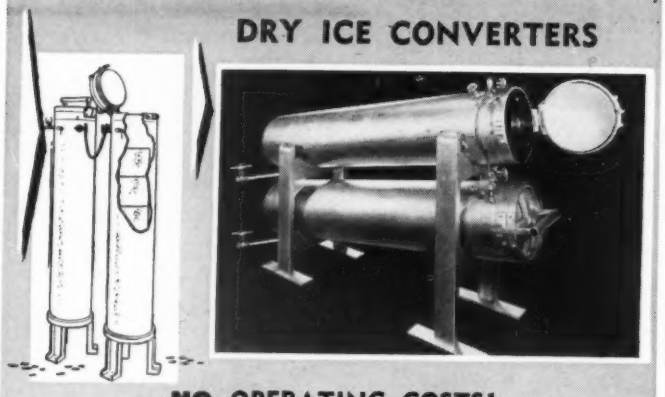

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## ASCE Streamlines Sanitary Engineering Division

Reorganization of the Sanitary Engineering Div. of the American Society of Civil Engineers — to enable it to provide wider opportunities for significant professional service by sanitary engineers in public and private practice — has been under way since mid-1951.

To reverse the trend to increased specialization and splinter movements that hamper sanitary engineers from presenting a united front both within and without the profession, the Joint Committee for the Advancement of Sanitary Engineering, initiated in 1952, is gradually assuming responsibility for all professional-level aspects of sanitary engineering practice, including certification, welfare, and inter-society relationships.

Three joint committees are now preparing manuals of practice with the American Water Works Association and the Federation of Sewage and Industrial Wastes Associations. Activities in the fields of sanitary engineering aspects of nuclear energy and atmospheric pollution are under study.

All in all, ASCE's Sanitary Engineering Div. is now organized for professional service in 14 fields of essential activity.

Invitations have been extended to the American Institute of Chemical Engineers and the American Society of Mechanical Engineers to participate in the Joint Committee.

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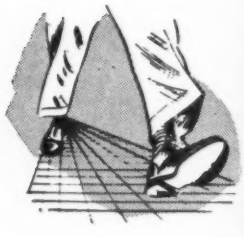

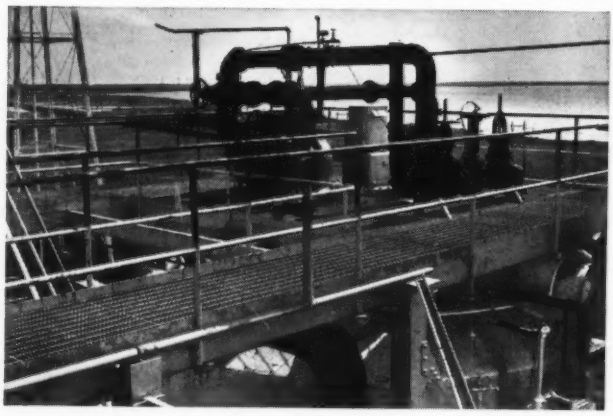

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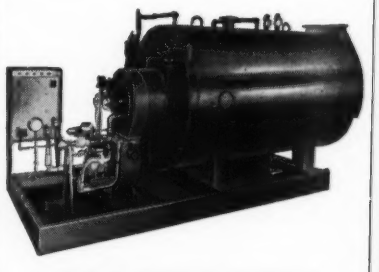

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# consulting engineers' calendar

| Date | Sponsor | Event | Location |
|---|---|---|---|
| Apr. 21-23 | American Institute of Electrical Engineers | Conf. on Feedback Control | Hotel Claridge Atlantic City, N. J. |
| Apr. 21-23 | Southern Asso. of Science & Ind. | Southern Ind. Waste Conf. | Shamrock Hotel, Houston, Texas |
| April 26-30 | American Society of Tool Engineers | Industrial Exposition | Convention Center Philadelphia, Pa. |
| April 27 | Association of Consulting Chemist and Chemical Engineers | Symposium-Banquet | Hotel Belmont Plaza New York, N. Y. |
| May 2-6 | Electrochemical Society | Indus. Electrochem. Div. | LaSalle Hotel Chicago, Ill. |
| May 4-7 | American Welding Society | Spring Meeting | Hotel Statler Buffalo, N. Y. |
| May 5-7 | American Institute of Electrical Engineers | North Eastern Dist. Meeting | Van Curler Hotel Schenectady, N. Y. |
| May 5-7 | American Welding Society | 2nd Welding Show | Memorial Audit. Buffalo, N.Y. |
| May 10-12 | Compressed Air and Gas Institute | Spring Meeting | The Homestead Hot Springs, Va. |
| May 16-19 | American Institute of Chemical Engineers | Summer Meeting | Springfield, Mass. |
| May 17-20 | Basic Materials Exposition and Conference | 2nd Annual Exposition | Amphitheater Chicago, Ill. |
| May 23-28 | American Water Works Association | National Convention | Seattle, Wash. |
| June 9-11 | American Society for Quality Control | 8th Annual Convention | Jefferson Hotel St. Louis, Mo. |
| June 14-17 | American Society of Mechanical Engineers | Oil & Gas Power Division | Muehlebach Hotel Kansas City, Mo. |
| June 14-19 | American Society of Civil Engineers | Convention | Chalfonte-Haddon Hall, Atlantic City |
| June 20-24 | American Society of Mechanical Engineers | Semi-annual Meeting | William Penn Hotel Pittsburgh, Pa. |
| June 20-25 | American Institute of Chemical Engineers | Nuclear Engr. Conference | University of Mich. Ann Arbor, Mich. |
| June 21-25 | American Institute of Electrical Engineers | Summer General Meeting | Los Angeles, Calif. |
| June 28-30 | American Society of Heating and Ventilating Engineers | Semi-annual Meeting | New Ocean House Swampscott, Mass. |
| July 13-15 | Western Plant Maintenance Show | Conference and Exposition | Pan Pacific Bldg. Los Angeles, Calif. |

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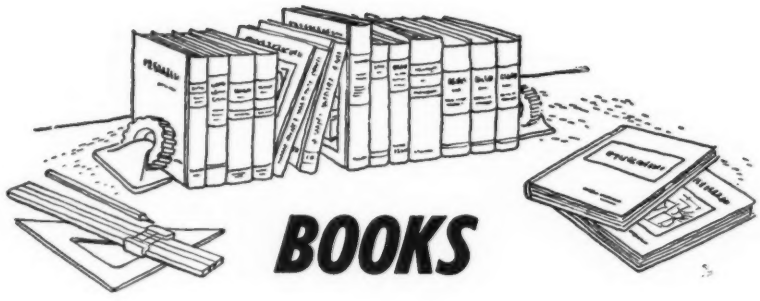

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MATERIALS AND PROCESSES (Second Edition), by James F. Young; John Wiley & Sons, Inc.; 1074 pages; $8.50.

This volume on Materials and Processes is one of a series written primarily for the General Electric Engineering Educational Program. The second edition has been expanded by 50 percent and brought up-to-date. The book includes a thorough coverage of developments of the last 10 years, particularly stressing the recent advances in physical metallurgy and chemistry as well as industrial practices.

The author, James F. Young, is a consultant on the staff of the Vice-President of Engineering of the General Electric Company, in New York City. He has been both a student and a supervisor in GE's Training program for graduate engineers.

Primarily, the volume is designed to present the interrelated information needed to apply engineering fundamentals of materials and processes to design, production, and control of products. It is written strictly from the viewpoint of the engineer and covers both metallic and nonmetallic materials and manufacturing methods.

FLOW AND FAN, by C. Harold Berry; The Industrial Press; 226 pages; $4.00.

Professor C. Harold Berry, of Harvard's graduates school of engineering, has brought both engineering and teaching experience together in this volume, which present basic calculations in the design of systems for moving air or other gases. The book deals with both the flow of gas through duct systems and the performance and control of fans.

The style of writing is as readable as conversation, and the arrangement of topics is suited to presentation of this rather complex subject to readers at various technical levels. The author admits that the arrangement "is not always logical" because of a desire to show the need for a result before a subject is developed.

One of the best features of this book is that it deals adequately with information which is difficult to locate elsewhere, but admirable restraint has been exercised in the inclusion of readily available standard reference material.

## ALSO AVAILABLE

CATALYSIS, Volume I, Fundamental Principles (Part 1), edited by Paul H. Emmett; Reinhold Publishing Corp., 394 pages, $10.00. The first of two volumes covering the general approaches and tools used to obtain a basic understanding of both homogeneous and heterogeneous catalysis, this book is devoted to supporters, carriers, and methods of preparation.

It presents comprehensive discussions, by engineers in the field, not only of long-established ideas and interpretations, but also of the wide range of newer concepts now associated with the field of catalysis. The very recent approach that attempts to link the activity of a solid catalyst with its electronic structure is covered in detail. This book, with Volume II, and a subsequent projected series of books on catalysis, should provide a complete reference set on the subject.

ATOMIC ENERGY IN INDUSTRY—2nd Annual Conference—1953; National Industrial Conference Board, Inc.; 265 pages; $10.00. The Atomic Energy in Industry Conference is a meeting of authorities on peace-time uses of atomic energy. This volume

presents the transcript of all addresses presented at this 2nd Annual Conference and provides a ready reference on engineering work being done in the nuclear field. This is a most valuable book for consulting engineers interested in atomic energy developments in this country and in Great Britain.

MAGNETIC COOLING, by C. G. B. Garrett, Harvard University Press, John Wiley & Sons, Inc.; 110 pages; $4.50. This little book is the first to appear in the significant and rapidly changing field of magnetic cooling since World War II. It gives a balanced review of work done in England, Holland, and the United States, calling particular attention to the progress and understanding achieved in the last ten years. This is one of the Harvard Monographs in Applied Science, that should be of interest to engineers, physical chemists, and nuclear physicists dealing with the phenomena occurring under extremely low temperatures reached by magnetic cooling.

METALS PROPERTIES—ASME Handbook; McGraw-Hill Book Company; 400 pages; $10.00. Sponsored by the Metals Engineering Handbook Board of the American Society of Mechanical Engineers, the complete ASME Handbook will consist of four volumes, of which this is the second. The first was *Metals Engineering Design*, published last October.

The new volume, Metals Properties, contains tabulated engineering data on the metallurgical, physical, fabrication, and mechanical properties of typical metals and alloys. The book provides data on more than 500 metals in common use. Designers will find in this volume information normally available only in a large number of widely scattered books, reports, and monographs.

## FILMS

"THE STORY OF THE ROUND-WOUND TRANSFORMER," Line Material Company, sound and color, 16 mm, 22 minutes. This movie explains the manufacture and testing of distribution transformers through 500 kva.

"WHATEVER WE DO", Air Reduction Sales Company, sound and color, 16 mm, 23 minutes. A basic documentary film about the atmospheric gases—oxygen, nitrogen, argon, helium, and other rare gases, covering their key uses in industry, and the numberless ways they appear in our daily lives as parts of familiar products.

"ULTRASONIC INSPECTION," Sperry Products, Inc. sound and color, 16 mm, 10 minutes. Latest techniques in ultrasonic testing of raw stock, finished parts, and plant equipment are illustrated with scenes taken in Sperry's research laboratories and customers' plants. The film also describes recent developments in immersion testing with Sperry "SIMAC' installations. Metal parts are inspected ultrasonically and the results recorded automatically.

"ALUMINUM ON THE SKYLINE," Aluminum Company of America, sound and color, 16 mm, 28 minutes. A documentary picture showing design and construction of Alcoa's headquarters office building including a description of events leading up to the erection of structure. The picture points up salient construction features and describes the design and fabrication of the building's aluminum curtain wall panels. In the final ten minutes, the film takes the viewer on a tour of the completed building.

"DYNAMIC MEASUREMENT," Consolidated Engineering Corp., sound and color, 16 mm, 30 minutes. Viewers of this film go behind the scenes with design engineers of a large manufacturer of oil refining plants to observe how tiny sensing devices known as "pickups" transmit electric signals to permanent oscillograph records to give warning of vibration factors that could seriously impair the delicate balance of a cooling tower fan. A number of other interesting applications of Dynamic Measurement are also reported.


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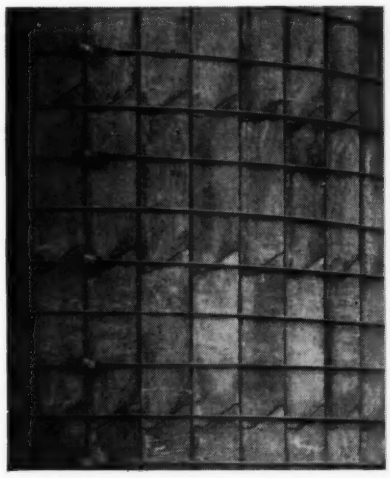

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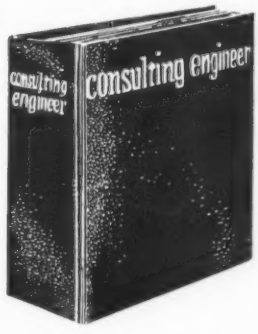


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# ADVERTISERS' INDEX


Aluminum Company of America .....8-9
American Photocopy Equipment Company ..... 60
American Water Softener Company ..... 68
Ammerman Co., C. L. ..... 80
Automatic Control Company ..... 79
Babcock & Wilcox Company, The ..... 61
Bayley Blower Company ..... 44
Belco Industrial Equipment Div., Inc. ..... 77
Bigelow-Liptak Corporation ..... 75
Blackmer Pump Company ..... 85
Bonney Forge & Tool Works ..... 81
Bruning Co., Inc., Charles .....66-67
Byron-Jackson Company ..... 83
Chain Belt Company ..... 19
Chicago & Eastern Illinois Railroad ..... 55
Coffin, Jr. Co., The J. S. ..... 11
Combustion Engineering, Inc. ..... 3
Dampney Company, The ..... 72
Dearborn Chemical Company ..... 59
Detroit Stoker Company ..... 69
Diamond Power Specialty Corporation ..... 10
Dry Ice Converter Corporation ..... 88
Fairbanks, Morse & Company ..... 7
Federal Electric Products Company ..... 65
Flexitallic Gasket Company ..... 16
General Cable Corporation ..... 87
Hays Corporation, The .....Second Cover
Heacon, Inc. ..... 4
Hills-McCanna Company ..... 78
I-T-E Circuit Breaker Company .....12-13
Jeffrey Manufacturing Company ..... 57
Johnston Brothers, Inc. ..... 88
Keckley Company, O. C. ..... 80
Kellogg Company, M. W. .....Fourth Cover
Neff & Fry Company ..... 91
New York State Department of Commerce ..... 84
Niagara Blower Company ..... 74
Oxy-Catalyst, Inc. ..... 40
Patterson-Kelley Company, Inc. ..... 48
Penberthy Injector Company ..... 62
Permutit Company, The .....Third Cover
Pick Manufacturing Company ..... 85
Prat-Daniel Corporation ..... 71
Reliance Gauge Column Company ..... 64
Standard Steel Spring Div., Rockwell Spring and Axle Company ..... 88
Titusville Iron Works Company, Div. of Struthers Wells Corporation ..... 76
Tube Turns, Inc. .....51-52
U. S. Hoffman Machinery Corporation ..... 58
U. S. Steel Corporation ..... 15
Wheeler Manufacturing Company, C. H. ..... 63
Whitlock Manufacturing Company ..... 70
Yarnall-Waring Company ..... 73


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